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A CENTRALIZED SOURCE OF INFORMATION FOR THE
MILITARY WORKING DOG PROGRAM

A Thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE

by

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B.S., Purdue University, 1975
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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency.
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ABSTRACT

A CENTRALIZED SOURCE OF INFORMATION FOR THE MILITARY WORKING DOG PROGRAM, by Major Denzil F. Frost, USA, 321 pages.

This study is in response to the lack of a comprehensive source of information concerning the production of high quality working dogs. Sources of information and the components required to establish a framework for a successful working dog program are identified and discussed by over 187 subject matter experts.

Forms of inquiry include a traditional literature search utilizing Dissertation Abstracts, Defense Technical Information Center (DTIC), the National Technical Information Service (NTIS), Index Medicus, FEDLINK Technical Notes, On Line Computer Library Center (OLCLC), a questionnaire, oral and telephonic interviews, and written requests for follow-up information.

The study concludes that: 1) The lack of a centralized system to consolidate and standardize pertinent information about the production and further development of working dogs is an industry-wide problem, and 2) Ample information, resources and expertise exist to ensure the optimum operation of any working dog program, once goals, resources, methods of procurement and training, and commitment by management are ensured.

Recommendations focus on the need to exploit outside expertise, and to establish an information management system designed to ensure that the sources of information described in this thesis are kept current. This in turn will serve as a foundation for further update, reference and study.

Implications for further research center on four factors identified by the author to be crucial to the MWD Program. They are the absence of a master plan, fragmented command and control (management), inconsistent methods of procurement, and the impact of rejection rates on the quality and quantity of the end product. Additional research needs to be directed at each of these factors in order to verify and demonstrate the optimum method(s) and principles involved in producing a consistent supply of top performing working dogs within the MWD Program.

ACKNOWLEDGMENTS

The completion of this thesis represents the contributions in time, knowledge and expertise of over 187 individuals. The author is deeply indebted for their willingness to provide information, and their encouragement to complete the work.

Special thanks are extended to COL Fred Helm for planting the seed for determining the optimum method to produce military working dogs. Numerous transformations have occurred since the initial planting, but the fruit is now ready to be plucked. The harvest will be left to others.

I would also like to thank a very competent graduate and consulting faculty for their guidance and cooperation. This is particularly true for Mr. Michael Baker, who spent many hours reviewing and providing valuable insight to the initial drafts.

The author also wishes to acknowledge the courteous, professional and timely support from the staff of the Combined Arms Research Library, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas.

But, I am most grateful to my sweet wife Paula and our special children Amy, Kenny, Ryan, Amber, Emily, and Aaron, for their patience, understanding and support during "the best 10 months of my life!" Their sacrifice and love highlight each line of the thesis. I dedicate this work to them.

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CHAPTER 1

Introduction

Currently, the war against drugs and increased terrorist activities are signaling the military working dog (MWD) to assist as a combat multiplier and deterrent. The canine nose offers significant potential because of its superior sensitivity to any other sensing device. Unfortunately, the U. S. finds itself in the same familiar position as it has at similar points in history. Throughout the 1980's, the need for MWD specialities has been increasing and has even expanded to the Using Agencies who are requesting dual-purpose dogs (Combined Arms Center, Laird: 24, Thornton, Wolbert). In addition, requirements have expanded beyond the traditional sister services to the Coast Guard, Border Patrol, Drug Enforcement Agency, Customs, Federal Aviation Administration, Secret Service, Federal Bureau of Investigation, and the United States Department of Agriculture.

Throughout the past decade, the Department of Defense Dog Center (DODDC) has had difficulty filling the requisitions for MWDs from the various Using Agencies (Burwell, Combined Arms Center, Frost, McCathern, Parks). This delayed response has led some of the agencies to create their own programs or to procure working dogs from contractors (Burke, Drexler, Frost, McEathern, Parks, Reaver).

A review of the production flow of MWDs indicates the absence of a centralized source of information that depicts the essential criteria of the MWD Program. A synopsis of the MWD Program within the context of existing regulations and other official documents concerns the history of

the MWD Program, MWD descriptions and tasks, and operations of each MWD specialty.

In an attempt to assess the current MWD Program, a questionnaire was submitted to 12 subject matter experts (SME) who had experience with the program. The questions dealt with procurement (evaluation criteria of behavior and physical attributes), the contributions of genetics, training criteria and standardization of training methods, rejection rates, costs of procurement, and research. A review of the responses within each question revealed marked disparity among the respondents. This diversity of opinion exists because there are no generally accepted standards. Based on these findings, the author concluded that it was impossible to evaluate any single program or method in an attempt to discover new knowledge about the science and art of producing MWDs.

Efforts to identify publications that describe either the science or the art of producing competent, multi-disciplined working dogs revealed the absence of a detailed comprehensive source. A large gap exists between what is known in the research world (science) and what is applied in the 'real world' (art). In other words, no evidence could be found that the art of producing consistent, top quality working dogs was based on scientific principles that ensure repetitive and verifiable results.

Statement of the Problem

There is an absence of any comprehensive source of information that addresses the production of high quality working dogs. Appendix A describes the developmental sequence of the problem statement.

Purpose of the Study

The purpose of this study is to identify and describe sources of information and to collect available information on the working dog industry that may prove to be useful in designing a successful working dog program. The intent is not to convince the reader of any one particular aspect or philosophy, but to present the spectrum of options and their implications so that the reader may understand the alternatives, may conduct detailed research, and may be able to make objective comparisons.

Assumptions

This study assumes that:

- The information and expertise required to address the problem statement exists but is not static.
- The study accepts the veracity of data collected from the field to be of sufficient quality, as to allow valid conclusions to be drawn.
- Expert consensus will yield valid conclusions, even though it is difficult to prove, on a scientific basis, whether an SME is right or wrong. If a group of SMEs reaches a consensus on a specific subject, the chance that all will be wrong will be minimal.

Definition of Terms

Military Working Dog (MWD) - A dog that has been trained to perform specialized tasks relating to law enforcement or physical security operations. These include scout, sentry, patrol, tracker, narcotic, contraband, explosives, and tunnel dogs (FM 19-35: 1-59; DOD Directive 5200.31).

MWD Handler - A Military Policeman who is qualified to care for, use, and maintain the proficiency of a trained MWD for the purpose of accomplishing a specific mission (FM 19-35: 2).

MWD Team - A MWD and its handler, trained to work together in performing law enforcement and/or physical security duties (Ibid: 2).

Sentry Dog - A MWD trained to assist in providing tactical or non-tactical security in and about fixed military installations as part of a physical security element. A powerful psychological deterrence against intruders and attack threat; a highly aggressive animal able to work either on- or off-leash, and controlled at all times by a skilled handler (FM 19-35: 2, 28-36; Thorton).

Patrol Dog - A MWD that is the most versatile single-purpose asset available. This dog can expand law enforcement capabilities and increase the physical security posture of a military installation. Flexibility of employment is enhanced due to its ability to perform numerous tasks (FM 19-35: 2, 11-27; Thorton).

Narcotic Detector Dog - A MWD trained specifically to detect the presence of marijuana and its derivatives. They are also capable of detecting hard narcotics such as opium, cocaine and heroin (FM 19-35: 2, 37-53; Thorton).

Explosive Detector Dog - A MWD with a particularly keen sense of smell that is trained to discriminate the scent of explosives (FM 19-35: 2; Thorton).

Tracker Dog - A highly trained MWD able to work silently (day or night) on a 25-foot leash following a "ground scent" over terrain not holding a visual sign, and to "signal" the handler when it is nearing the subject being

tracked. This dog is an integral part of a reconnaissance element used to detect direction of enemy movement. This asset was last used during the Vietnam War. The Labrador Retriever has been found to be the most competent breed for this mission. It is currently being considered for use in an expanded role (Combined Arms Center; FM 7-42; Thornton).

Scout Dog - A MWD trained to work silently either on- or off-leash, day or night, to detect an airborne scent, and to "signal" the handler when it has picked up the presence of nearby dangerous objects or personnel. It is also used to support maneuvering infantry elements in a wide range of tactical missions, day or night, under all weather and terrain conditions. This asset was last used during the Vietnam War. It is also currently being considered for use in an expanded role (Combined Arms Center; FM 7-40; Thornton).

Mine and Tunnel Detector Dog - A MWD trained to work silently, to detect and locate (by a combination of ground scents) all types of metallic and non-metallic mines, boobytraps, tunnels and bunkers; and to support maneuvering infantry elements on specific missions. This asset was last used during the Vietnam War. It is also currently being considered for use in an expanded role (Combined Arms Center; FM 7-41; Thornton).

Search and Rescue - A MWD that is highly trained to locate injured personnel, day or night, under all weather and terrain conditions. This asset is currently considered for use in a future expanded role (Combined Arms Center; FM 7-41; Thornton).

Untrained Dog - A dog that has not received formal training in the specific categories listed above. The criteria used to evaluate performance conditions of an untrained dog are aggression and attack(Taylor, B.).

Partially Trained Dog - A dog that has had some degree of obedience and attack training. The required conditions under which performance is evaluated are: obedience, aggression, false run, attack, out/heel, and escort (Taylor, B).

Fully Trained Dog - A dog that is trained in attack and obedience. The required conditions under which performance is evaluated are: obedience, aggression, false run, attack, out/heel, stand-off, search/re-attack, and escort (Taylor, B). (Author's Note: Detector Dogs can also be fully trained.)

Dual-Purpose Dog - A MWD that is trained to be proficient to perform 2 distinct specialties, usually patrol and narcotics detection or patrol and explosives detection.

Trainability - The ability of an animal to consistently learn and respond to specific cues or signals to perform specific tasks.

Socialization - A phase or limited period of time in a dog's early life that has been shown to be critical to the formation of a strong social bond with man. This period begins at approximately 3 weeks of age and extends out to the 12th week of life. (Scott, Psychomatic Medicine and Science).

Olfactory Sense - The ability to detect and discriminate odors at various concentrations.

Hip Dysplasia - A complex disease in dogs that involves the coxofemoral (hip) joint. This is a developmental disease characterized by varying degrees of hip joint laxity, subluxation and the subsequent development of degenerative joint disease. The etiology is considered to be multifactorial in origin, combining the multiple effects of polygenetic, nutritional and environmental factors, such as size, growth rate, exercise, pelvic muscle mass, maternal estrogen concentration, and *pectineus muscle* dystrophy. It

is observed to occur bilaterally in more than 90 per cent of the cases observed. The incidence of this condition tends to occur more frequently in breeds of dogs that are poorly muscled, acromegalic, and tend to grow rapidly (Bloomberg).

Subject Matter Expert - A person having direct contact in any of the following areas relating to the MWD Program, or similar working dog program: Training, procurement, instruction, management, or research, or who has practical experience in canine genetics, behavior, breeding, reproduction, or veterinary medicine.

Using Agency - An organization that solicits the delivery of a specifically trained MWD from DODDC, or the services thereof.

Expanded Role - A mission or task proposed to be accomplished by a MWD based upon historical precedence or due to improved understanding of the MWDs capabilities.

Limitations

- Pertinent data may not be available, or may be incomplete, due to specific policies of general nondisclosure or proprietary interests designed to preserve the competitive edge.
- Contacting all potential sources of information, especially outside the U.S., is not possible, primarily due to time constraints.
- A value assessment of the data based on peer review, technical or professional proficiency, or education is beyond the scope of this study.
- The study will be limited to data collected, identification/description of the sources, and implication of their impact on the problem statement.

Delimitations

- Collection of data extended from 1 August 1989 to 15 April 1990.

CHAPTER 2

Historical Overview

The Dog's Association With Man

Throughout history, the dog has been an important part of man's domestic life and his wars (Glover: 435). Within this association the dog has been an enemy, a friend, and a servant. In all probability, the dog volunteered to associate with man for the small payment of food and attention (Budiansky: 75, Pugnetti: 11). Other animals have also been trained by man, but they require capture, restraint, and taming by force. The dog is one of the few animals that has acceded to man voluntarily, without constraint (Pugnetti: 11). No other animal expresses the delight of the dog to please his master. The dog's devotion to man is without parallel in the animal world, in apparent rejection of his own kind. This bond between the domestic dog and man has been so refined that if a pup is taken from the litter and raised by man for only a few weeks, he will prefer to remain with man when offered the choice of returning to his littermates. To the degree that man understands the source of this devotion, this desire to please, is the extent to which man can utilize and appreciate the full spectrum of the dog's capabilities.

Requisites for that understanding include a determination of what a dog is, where he came from, and identification of the characteristics or attributes that have led man to develop and maintain such close association with one species of animal. Pugnetti estimates that the dog has reproduced domestically for over 5,000 years (Pugnetti: 12). The social organization, instinctive mental structure, in conjunction with a mutual agreement on the

division of labor, and food and lodging, have fortified the relationship between the dog and man for thousands of years. The influence of mutual survival interests reflect the antiquity, commonality, and uniqueness of the human-canine bond. The ancient beginnings of this bond can still be seen today among various Indian tribes in Paraguay and Peru, where orphan pups are nursed by women (Pugnetti: 11). The dog is also unique from most other animals in that it can demonstrate initiative, become excited, express jealousy, and it can still be childish in nature (Pugnetti: 32). In fact, the dog shares so many of the vicissitudes of life with man that the dog has been referred to as "an honorary human being" (Pugnetti: 11).

In all probability, the dog shares a common ancestry with the wolf and was domesticated approximately 10 to 12 thousand years ago (Scott and Fuller: 35; Bielfelt; Budiansky: 76). Based on this long association with man, one might expect a wealth of data with specific emphasis on how to produce dogs to serve man. Unfortunately, this is not the case. The majority of information in the literature centers around fossil, prehistoric, historic, genetic, anatomic and behavioral evidence (Allen: 432-503; Packard: 896-901; Scott and Fuller: 29-56, 397-411). Ash gives an excellent review of the dog's history and breed development.

The dog's long association with man may be due to simple commonality. Dog owners throughout the ages would agree that loyalty, courage, endurance, intelligence, an exceptional sense of smell and hearing, and the ability to detect very small movements are all common denominators that comprise the special human-canine bond. Although a myriad of training books have been written about the influence of these characteristics on the development of specific breeds, very little objective information is

available. A common body of knowledge on the options of how to produce a composite product of a working dog from the 'ground up' could not be found.

The use of dogs in war is not new. Since the earliest days of recorded warfare, man has employed dogs as combatants or in direct support of combat operations (Downey: 8; Laird: 1; Wanner: 32; Walter: 51-54; Stauffer: 1). During the Spanish conquest of the Americas, a dog named Mohama was awarded a "horseman's share" of the spoils because he fought so valiantly (Varner: XVI).

Due to the pressure of emerging technology and the dynamic nature of warfare, the military use of the dog as a primary combatant has steadily diminished. Numerous historians have cited the development of gunpowder as the bench mark for this decline (Archer: 4; Laird: 1; Risch: 324). Commensurate with technology came enhanced lethality on the battlefield, and the eventual changes in military strategy, planning, and tactics. Throughout history, technology has continually advanced, with the technology of the day eventually becoming outdated and fading into the past. The dog, however, has always been there when a fight broke out, although to varying degrees depending on the combatants' perceived value of the dog as a combat multiplier.

This responsive adaptation substantiates the diversified capacity of the dog's ancient inherent capabilities, which changes with technology. This confirms that the dog should not be considered solely as a device of war, but as a living entity similar to the soldier. This symbiotic relationship exists because regardless of the state of technology, it requires operation by man. And this has always placed the dog back in his ancient natural role as a biological detector, either as a friend or a foe.

Living organisms, which are the best detectors of other life forms, are referred to as biosensors. The dog is the most common and familiar biosensor, although geese, guinea hens, and marine mammals such as the bottle-nosed dolphin are also excellent examples of biosensors (Ridgway). Due to the rapid emergence of technology, the dog's usefulness in war has been due to his detection capabilities. The greatest fear of the famous Soviet Spetsnaz is the enemy's dogs (Suvorov: 102-105).

Cooper reports that during World War II, the U.S. military evaluated numerous species of animals as biosensors. The most efficient mine detectors were determined to be pigs, coyotes, cats, raccoons, skunks, deer, ferrets, and dogs. She indicated that the pig clearly out-performed all of the species examined, but the dog was chosen due to more apparent practical utility (Cooper: 70).

Biosensors have numerous capabilities and limitations, as do other systems. Inherent capabilities that make the dog a valuable military asset include the following. The dog:

- Is light, compact, highly mobile, can cover more area in less time than a man, and is easily transported by conventional means.
- Excels in a variety of combat conditions to include low intensity conflict and is very effective at night.
- Can go wherever man can go, plus many places man cannot go
- Operates well in all climates, at minimal cost, and with minimal maintenance and supply requirements.
- Has excellent intelligence.
- Is a proven millennial combat multiplier.

- Can be an excellent deterrent.
- Is difficult for man to detect.
- Cannot be used by the enemy if captured.
- Is inexpensive to produce when compared to modern electronic systems, plus there are no electrical malfunctions.
- Has no political/moral persuasions.
- Can distinguish between dummies and real targets, with tremendous pin pointing capability.
- Is capable of being recalled and reused quickly.

The dog's limitations include the following. The dog:

- Is subject to outside influences that can have a direct bearing on its behavior and performance, such as artillery fire, decomposing bodies, dust, and engine exhaust fumes. Males can be distracted by bitches, both sexes can be distracted by other dogs, other animals, people, food, or anything that may strike the dog's curiosity.
- Can tire, become fatigued, be injured, and display inexplicable days when he does not want to work, all of which affect performance.
- Reflects the mood of its handler.
- Cannot be expected to work under every type of combat environment, but must be considered an ancillary combat resource to be used once a timely, comprehensive intelligence plan of the battlefield has been conducted and analyzed.
- Cannot be turned on and off with a switch.

In spite of the accumulated military use of dogs through the ages, the dog was not a viable military asset of the U. S. military prior to World War II (Risch: 324). During World War I other countries made extensive use of organized and specially trained dogs. Estimates of the total number of dogs used by all nations was approximately 75,000 (Downey: 3). Germany alone used approximately 30,000 (Ibid). These dogs proved their usefulness as messengers, scouts, guard dogs, and transporters, as appropriate for their size (Laird: 1; Stauffer: 12). All of these roles concentrated primarily on support of infantry operations. The U. S. entered this war without any dogs, but began procuring approximately 500 dogs every 3 months from the French and the Belgians (Clark, letter).

World War II witnessed further involvement of dogs. When Japan bombed Pearl Harbor in 1941, the U.S. military inventory contained only sled dogs (Fischer: 51-57; Risch: 324; Stauffer: 13). By the end of the war, the total number for the Allies and the Axis Powers was over 250,000 (Archer: 4). Again, Germany used the most (200,000), with the U.S. employing around 19,000 (Laird: 3, Pugnetti: 4). Stauffer provides a comprehensive breakdown by country of the use of dogs in World War I and World War II (Stauffer: 4-16). During World War II the dog's usefulness also expanded, as did the number used. The leading role was as a scout (Laird: 2). During this war man also began to use dogs in novel ways, which again illustrates the dog's ability to complement man's ingenuity. Kelch gives a comprehensive overview of the various roles served by dogs in war (Kelch: 33-41).

The Red Army used 60-70,000 dogs for fighting alone in World War II, and an unknown, but large number for transport (Stauffer: 15; Sukhomlin: 93-98; Suvorov: 104). The largest roles for the Russian dogs were mine

detection and the destruction of tanks (Arthur: 5; Author Unknown: 30-32; Stauffer: 15; Suvorov: 104).

The Russian's organized military use of dogs began with the establishment of the Central Military School of Service Dog Breeding on 23 August 1924 (Moskovskiy: 2). During World War II, Russian dogs delivered 200,000 reports, evacuated almost 1 million wounded, delivered over 1 million tons of supplies to the front line, discovered over 4 million mines, and destroyed 300 tanks (Moskovskiy: 2, 3). The Russians considered mine detection dogs to be more effective than men with mine detectors (Author Unknown - "Soviet Dogs vs German Tanks: 30-32). The antitank operations occurred primarily in the battles prior to Moscow, Stalingrad and Kursk (Moskovskiy: 3; Suvorov: 104). The demand for dogs was apparently so great that Poland was depleted of all its dogs by the Russian suicide mission recruiters (Cooper: 71). The surviving dogs were given the honor of riding in the victory parade in Red Square (Suvorov: 104).

An important lesson that underlies the importance of understanding how the dog is motivated and perceives his world can be found in the Russian use of dogs to destroy tanks (Chao). The Russians trained their dogs by only feeding them under moving tanks. Prior to being used for these missions, they were held without food for several days and were directed towards the advancing German tanks with explosives strapped to their backs (Suvorov: 104). The technique worked well as long as the German tanks were advancing and Russian tanks were not in the vicinity. This technique became more haphazard once the Russians gained the momentum and began to push the Germans westward (Sukhomlin: 96). One explanation for the poor performance in the attack mode was due to the fact that the Russian

tanks used diesel and the German Panzers used gasoline. As a result, when given the choice of looking for food under one or the other tanks, the Russian tanks were usually chosen because the dogs were more than likely keying in on the familiar diesel fumes (Author Unknown - "Soviet Dogs vs German Tanks: 30-32). In either case, successful completion of the mission was always hard on the dogs.

Soviet news articles about the Afghan War indicate that dogs are still considered a critical asset for mine detection (Turbiville: 560-565; Shumilov: 22, 23; Starodymov: 66-68; Yefimov: 2). The Soviets undoubtedly have increased the dog's use as a combat multiplier (MacMurray, Suvorov: 104, 105). Soviet dogs also continue to perform many tasks, both traditional and innovative, for the Spetsnaz (Suvorov: 104). And as mentioned earlier, the greatest deterrent is another biosensor.

During the Korean War, less than 35 dogs were used, despite the fact that dogs were credited with reducing patrol casualties by 60-65 per cent (Clark, letter; Unknown Author - "War Dogs"). Towards the end of the war, the U.S. Army approved the training of a dog platoon for each of the 5 divisions in Korea, but the war ended before the training could be completed.

Dogs were used extensively in Vietnam, following a gradual buildup to a maintenance level of approximately 2000 (Clark, telephone interview; Kelch: 37, 39). At the end of the Vietnam War, the U. S. war dog inventory began to decline, as did the expertise to train and deploy such unique specialties as the Combat Tracker Dog, Mine and Tunnel Dog, and the Scout Dog. The last printing of the manuals to produce these dogs was in 1973 (FM 7-40, Appendix A; FM 7-41, Appendix A; FM 7-42, Appendix A). The human expertise has also been diluted with time (Combined Arms Center, Thornton).

To conclude, the U. S. has used dogs in a very inconsistent manner and has never been prepared to utilize the dog's capabilities at the beginning of a conflict. Britain, Germany, France, Sweden, to mention only a few, continue to maintain dogs for use in war.

Development of the U.S. Military Working Dog Program

During World War II, Americans were asked to provide dogs to assist in the war effort. In fact, the primary proponents of the program were U.S. citizens who wanted their dogs to serve. At that time the primary use was for sentry duty (Laird: 2; Stauffer: 17-19). After the war, the Army's requirements for MWDs gradually decreased, concomitant with an increased need by the Air Force. As a result, the Air Force was assigned training and management responsibilities for MWDs in December 1956. The Air Force subsequently closed the Army Dog Training Center in July 1957 (Laird: 3, 4). This resulted in the establishment of the Sentry Dog Training Branch of the Department of Security Police Training at Lackland Air Force Base, Texas, in October 1958 (USAF Fact Sheet).

The Army remained responsible for procurement until 1964 (Laird: 3, 4), at which time the Air Force was assigned the responsibility of procuring live animals not used for food. The Air Force decided to employ more strict requirements not only for procurement, but also for dogs already in the system. In 1964 over 1,500 mail and telephone offers were being received each month (Laird: 5). Because of the improved selection criteria, over 50 per cent of the offers were rejected. The major causes for rejection were hip dysplasia, heartworms, elbow dysplasia, elbow arthritis and temperament (Laird: 25). The Air Force began an advertising campaign to

announce the new standards and the needs of the DOD Dog Program. Private citizens were encouraged to bring their dogs to temporary mobile team sites located throughout the U.S. (Laird: 11). Results of the new program were deemed a successful recruiting effort (Laird: 11).

In order to create a more efficient and unified organization, separate activities for procurement, logistics, and training were centralized at one location, namely San Antonio, Texas. This resulted in the formation of Detachment 37 (Laird: 17). The attempt at geographical centralization, with separate command and control for each aspect ranging from procurement, training, logistics, recruiting, and veterinary care, amplified the problems of developing the program. The dog represented a one-of-a-kind commodity that was different from bolts, fuel, jet engines, or training recruits, and that had to be fed and attended to at all times (Laird: 17-20, Lees). The individual proponents had little experience dealing with the unorthodox problems/situations presented by this new member of the Air Force cadre.

Detachment 37 became the DOD Dog Center in 1971. The primary intent was to create a more centralized organization. During this time the use of MWDs in Vietnam was at its peak. The following list depicts the different missions performed by MWDs in Vietnam (Laird: 23):

- Untrained Dog
- Patrol Dog
- Sentry Dog
- Scout Dog
- Patrol/Narcotics Dog
- Patrol/Explosives Dog
- Tracker Dog

- Mine & Tunnel Detector Dog
- Detector Dog
- Explosive Dog
- Water Dog

The need for MWDs dropped markedly after the Vietnam War. The decrease in demand was only temporary, due to an increased demand for MWDs from non-DOD government agencies such as the Department of Justice, Department of Transportation and the Treasury Department. The stimulus for this exigency centered around illicit drugs and the need to detect explosives at airports (Laird: 24). Given these new missions, the DOD Dog Center began considering smaller breeds of dogs to integrate into the MWD Program. These dogs demonstrated acceptable capability to detect drugs and explosives, when compared to the German Shepherd, but due to their limited role as detectors only, further procurement was discontinued and primary emphasis continued to be on the German Shepherd, and traditional law enforcement missions (Laird: 25).

The increased demand for drug and explosive dogs eventually began to be felt throughout all federal and civilian law enforcement agencies. The result was an intensified recruiting competition for German Shepherds. As a result, the DOD Dog Center increased its deployment of mobile buying teams (Laird: 25). In addition, the DOD Dog Center began to accept dogs that were mailed in if they passed a preliminary examination by a military or civilian veterinarian. Animals that passed this examination were shipped to Lackland Air Force Base (Laird: 26). This system continued until 1984 when it became apparent that the supply of acceptable dogs was not adequate.

The DODDC then decided to send mobile teams to Western Europe, where there was an ample supply of working dog stock in West Germany,

Holland and Belgium. A reduction in the backlog was almost immediate. In addition, a new breed, the Belgian Malinois, was discovered. Many feel that this breed is comparable to the German Shepherd (Andersen, Craig, Pugnetti, Taylor, B; Ward). Justification for the selection of this breed was based on the dog's ability to hold a bite and the fact that it was comparable in temperament to the German Shepherd. The European dogs also came with some obedience and attack training. However, this "European solution" turned out to be only temporary, as rejection rates continued to remain high, and continue today in the range of 25 to 50 per cent (Andersen, Burke, Craig, Hayter, McCathern, Parks, Thornton). Numerous civilian working dog training facilities are also tapping into the European market, (Drexler, Reaver, Sexton), and the DODDC is again experiencing stiff competition.

Numerous trade journals (Police, The Law Enforcer's Magazine, K-9 Enforcer, Howl, National Institute of Justice Reports, Dog World, etc.) offer helpful information about successful programs, and there are a few books (Eden) that address the varying facets of a working dog program. But these publications are very general in nature and are based primarily on opinion and experience (art). This assessment is not meant to be derogatory, but to simply illustrate that pertinent information and expertise remains isolated due to the absence of effective communication.

A review of current official military (Department of Defense, Army and Air Force) regulations, field manuals, directives, pamphlets, and fact sheets relating to the MWD concentrate primarily on the performance of specific missions (see Appendix H). Sparse or only general information relating to the critical aspects of producing consistent top quality, high performing MWDs could be found. The author does not intend to imply that such

information should be included in these publications, but rather that a need exists for this essential information; and that it should be maintained, readily accessible, and expanded.

In summary, this chapter illustrates that the dog has had a long and distinguished association with man, but that the American military continually reinvents the wheel each time a crisis develops and it is realized that the dog could help. The U.S. Military has not been consistent in its development of an effective working dog program.

Most would agree that our military preparedness has also been erratic. We have not kept records on how to develop and sustain an effective dog program during a major crisis, nor have we recorded the lessons learned. Attempts have been made, but they have not been consistent. For example, a conference was held in March of 1970; the purpose of which was to explore the usefulness of the military working dog (Air Force). Many applicable topics were discussed, both from scientific information and the art of practical application, on how to produce a competent working dog. Unfortunately, the next such conference with similar intent was not held until May of 1989 (Combined Arms Center). The majority of the time at this conference was spent discussing the problems and challenges facing the MWD Program and trying to reach a consensus on direction and emphasis. The last printing of the manuals for the Tracker, Mine and Tunnel and Scout dogs was in 1973. Manuals can be reprinted much easier than lessons learned can be compiled and expertise mobilized.

This review of the unbalanced nature of progress in the MWD Program highlights the need for centralized collection and distribution of information required to maintain a viable MWD Program. Any interested

party could do it, but the military is the most likely candidate because it is the only one that acknowledges a problem and could use the information to get back on track. This conclusion then leads to the central problem of this thesis: the lack of a centralized source of information and standardization of all aspects involved with producing top quality MWDs.

CHAPTER 3

Methodology

Introduction

The search for information consisted of reviewing the background of the dog, to include its origin, ancestry, behavior, association with man in war, and the evolution of the U.S. MWD Program. In addition, the study involved a search for pertinent data and other sources of information, and the identification of subject matter experts. The search began within the MWD community by using a survey to collect data necessary to assess the operation of the current MWD Program, to address the Problem Statement of the thesis, and to provide conclusions and recommendations. Other forms of inquiry included a traditional literature search utilizing Dissertation Abstracts, Defense Technical Information Center (DTIC), the National Technical Information Service (NTIS), FEDLINK Technical Notes, On Line Computer Library Center (OLCLC), Index Medicus, a questionnaire (Appendix B), oral and telephonic interviews, and written requests for follow-up information.

Framing the questions

The questionnaire served primarily as a tool to assess the status of the current MWD Program, with respect to history, direction, emphasis, and major problems. The respondents (12) all have or have had first hand knowledge and experience specific to the MWD Program.

What to Ask

- What are the key components of a successful working dog program with respect to training, procurement, veterinary care, distribution, utilization, and management?
- Who is responsible for training, procurement, veterinary care, distribution, utilization, and management?
- What guidance exists in unit Standing Operating Procedures or other documents to identify and assign responsibilities for successful operation?
- What are the command and control elements in the MWD Program?
- What is the current state-of-the-art of the essential elements identified above?
- What is the current status of the MWD Program?
- What is the current ability of the MWD Program to fulfill its mission?
- What are the key problems/obstacles associated with the MWD program?
- Which options are more cost effective?

Who to Ask

- Personnel currently or previously assigned to DODDC, or related positions/activities associated with the MWD Program
- Research scientists
- Command and control personnel
- Private working dog contractors - procurement and/or training organizations
- Authors of publications in related subject areas

Construction of the Questionnaire

The next step was to employ a primary survey instrument. A questionnaire was chosen as the most appropriate instrument for initial collection of data because of the wide distribution of potential respondents and the desire to provide the respondents with a guarantee of confidentiality.

The questionnaire was designed to reduce bias by asking the respondents both sides of each question. The intent of the questionnaire design was to tailor the questions to focus on the collection of data from the perspective of someone involved with procurement and training, management, research, or field experience. This allowed the respondents total freedom in answering the questions and helped avoid any possible bias associated with formatted responses. The danger was that the respondents might not address the data element sought by the questionnaire. Second, the questions were formatted for the respondent. This gave the respondent a limited pre-focused field of reply to chose from in answering a specific question. The danger here was that the questionnaire might bias the outcome by limiting the possible responses to a specific question.

A combination of both options was used. The nature of the pre-formatted responses were kept general in order to facilitate a wide spectrum of responses, and the respondents were encouraged to identify other possible answers to the questions. Finally, a third bias filter was employed by categorizing the responses for each question and then weighing those responses by frequency of occurrence.

Other Forms of Data Collection

The primary purpose of the questionnaire was to assess the current operation of the MWD Program and to categorize the weighted responses. At that time, more specific questions were formulated and submitted to the 12 questionnaire respondents either in written correspondence or via telephonic or oral interview. Requests were also made for referrals of additional subject matter experts, documented sources of information, and organization/activities involved in pursuits that might complement and enhance any of the disciplines associated with the MWD Program. Memoranda for Record (MFRs) were used to document information received from telephonic and oral interviews.

Disposition of Data

All questionnaires, MFRs, correspondence, published material, brochures, video tapes, and other miscellaneous referenced material collected during the study were categorized and remain in the possession of the author.

Upon return of the questionnaires, the responses were analyzed for comment variety and similarity. The response commonality and range were then be categorized by question (Appendix C) and used to set the framework upon which to address the problem statement.

From this foundation, references were solicited either directly from the respondents or from written documents in which the respondent was an author, co-author, or is referred to by the author(s) of the document. During this phase, numerous references to qualified civilians and other government agencies became apparent. Contacts were then made with all possible

sources. This sequence served not only to validate the questionnaire responses, but also to facilitate investigation into many less apparent aspects relating to the main problem. The intent was for the process to continue until the same subject matter expert was mentioned by at least one other source. This did not occur for all cases due to time constraints, diversity of discipline, and/or region of emphasis. Other traditional sources of information applicable to the topic included refereed journals and other forms of public information.

As the information began to come in, it was categorized into sub-components that reflected back to the central problem. The variety of responses was also expected to stimulate further inquiry and frequently led to unapparent caches of valuable information.

Once categorization was completed, each sub-component was evaluated, based on the frequency of responses and feasibility of resolution.

CHAPTER 4

Study Results

Introduction

This chapter is divided into 2 sections: 1) Works cited - This section contains works that are referenced in the thesis or included to promote further research. The Defense Technical Information Center (DTIC) and the National Technical Information Service (NTIS) reference systems provided numerous articles and additional leads. Document numbers are indicated for each reference cited. DTIC and NTIS addresses are listed in Appendix D. An additional source of information that just came on line in January 1990 is the EPIC service offered by Online Computer Library Center, Inc. (OCLC). Unfortunately for this thesis, it was not yet available at the Command and General Staff College Library (see Federal Library).

2) Description of Contacts - These are people who have expertise in the field, or who represent institutions or organizations that are capable of providing information relating to the central problem of the thesis. They may not be cited in the text. Appendix H contains a list of addresses and telephone numbers for these contacts. Official military regulations and other U. S. Government documents applicable to the MWD Program are listed separately in Appendix A. The symbol Ω is used to indicate persons/organizations in the Works Cited section that are also listed in the Description of Contacts section.

The Works Cited and the Description of Contacts sections represent an attempt by the author to provide an overview, in its entirety, of all of the conceivable facets, expertise, and opinions involved in the production of a

working dog. The goals were to address the central problem statement of the thesis; to provide a basis for an understanding of how to unify the efforts of all concerned parties; and to bring the majority of the resources together under one book cover. The common topics examined include different methods of procurement, selection criteria, training techniques and philosophies. Basic and applied research articles are also included in order for the reader to understand, from the molecular and genetic levels, the potential of the dog's various capabilities. Inclusion will argue that until the basics of canine olfaction, sight, hearing, and behavior are understood, we will be bound to experience the inexplicable behavior and events of dogs that may diminish the future use or disuse of the working dog (see Author Unknown, "Soviet Dogs vs German Tanks", Chao).

With regards to procurement, the reader will find examples of organizations that procure their animals from animal pounds and/or shelters, solicit donations or sales from the public, breed their own dogs, or buy them from an independent breeder. The advantages, disadvantages, and the reasons presented for each option are included.

Selection criteria and its importance also vary greatly from the various works cited, but common denominators such as high play and retrieve drives, health, curiosity, and body carriage features become quite evident. An important co-factor to the selection criteria, however, is the experience of the evaluator and his/her perception of the dog's eventual capability to complete training.

On the subject of training, general training philosophy appeared to dominate the majority of comments. The author sensed that some of the respondents were hesitant to share or discuss in detail their specific

training techniques. Nevertheless, the reader will note a rich variety of approaches to training, and can see that training success varies with the motivation drive used, such as play, retrieve, praise, water and food.

Basic, and more importantly applied, research topics are presented to demonstrate directions or trends for future research in order to better understand the dog's capabilities. Information regarding the development and current state-of-the-art of microsensors is also presented to show the capability of the dog's primary detection competitor.

Comments about the MWD Program, within and outside of the military community, were for the most part negative. The majority of the respondents mentioned specific problems relating to procurement, training, and command and control, with numerous suggestions on how to resolve the problem areas. Inference for potential applicability to the MWD Program from these other programs should become quite evident.

The reader will also note that many of the programs discussed herein have not always been consistent or ongoing. Long term objectives, commitment, efficient utilization of resources and the end product all play crucial roles in determining the efficacy of a viable working dog program.

Works Cited

Adams, Cyril. Mammalian Egg Transfer. Boca Raton: CRC Press, 1982.

Although egg transfer was first reported in 1890, little attention was given to this technique until the mid-1950's. This book provides a good overall perspective of techniques used and the trends for future use and development. Laboratory work dealing with 16 species, to include the dog, is presented. This book is cited as a source of information

delineating the current state-of-the-art and obstacles which must be overcome or addressed should a breeding program/kennel option be considered. Concerning embryo transfer, Adams states that the assumption of a steady supply of embryos is a myth using current technology because there is only a 60 per cent chance of success at each of the 4 successive steps required to complete the transfer of the embryo. Adams equates this to an overall success ratio of 13 per cent (0.6¹; page 222). The reader is referred to Rankin for information relating to the current commercial capability of embryo transfer and the potential for development.

Air Force Office of Scientific Research. "Conference of Research to Expand the Usefulness of the Military Working Dog." November 1970. NTIS AD 716392. Proceedings from this working conference centered around aspects of procurement, training, medical problems and research. New techniques and roles for the MWD were discussed from the background of ongoing research designed to study olfaction, physiology and psychology of the dog.

Alderhorst Kennels. Video tape. This tape describes the activities and training philosophy of this kennel. The kennel, in operation since 1976, occupies 8 acres of land. Its founder, David Reaver, is certified by the state of California to train working dogs. In addition, Mr. Reaver is also a graduate of 2 West German police dog training schools (Reaver). The Kennel has a former German police dog trainer on staff who has over 26 years of training experience. The tape states that this kennel is the largest private dog school in the world. The tape emphasizes the quality

of their instructors and lists the following requirements that must be met and maintained:

- 1) Must be a graduate from a certified police handler school.
- 2) Must have been a working police dog handler for at least 3 years.
- 3) Must be a graduate of a certified police detection course in either explosives or narcotics.
- 4) Must have at least 1,500 hours as an instructor/trainee involved in at least 40 entry level dog/handler teams.
- 5) Must have a teaching credential certificate from the state of California for police science or police service dog training.
- 6) Must be certified as an advanced police instructor.
- 7) Must pass both a written and oral exam.

The primary aim of the training is to keep exposure liability to a minimum. The tape further states that Alderhorst is an official voting member of the World Police Dog Trials that are held twice a year in West Germany. This is an honor that is given to very few organizations throughout the world. The tape reviews the philosophy of only buying dogs with the Schutzhund, Schäferhund Verein, or the Royal Dutch Police Dog (KNPV) titles and explains why the dogs are imported from Europe.Ω

Allen, Glover M. "Dogs of the American Aborigines." Bulletin of the Museum of Comparative Zoölogy LXIII(1920): 431-503. Allen concludes from evidence on teeth characteristics that the dog descended from the wolf, rather than from the coyote, jackal, or fox, and that based on the skeletal similarities to European and Asian dog, he states that the American dog probably came from those continents with their human companions.

Although he acknowledges the possibility of interbreeding with coyotes,

and foxes, the effects of the progeny on the original genetic stock was minimal.

Allen, R. W., Franscesca Stewart, A. O. Traunson, M. Tischner and W. Bielanski. "Viability of Horse Embryos After Storage and Long Distance Transport in the Rabbit. Journal of Reproductive Fertility 47 (1976): 387-390. This reference agrees with Adams that prior to commercial exploitation embryos need to be cultured to a stage that will allow the embryo to 'mature' and thus facilitate successful transfer to a receiving uterus. This has been shown to be readily achieved for numerous species by using the rabbit oviduct (Adams: 222).

Allman, William F. "The Story of Life Unfolding." U.S. News and World Report, May 22, 1989: 58-59. This article contains comments from leading researchers who are searching for the master controls located in genes that determine whether an ant or a man will be produced from a fertilized egg. The diversity of living life forms is discussed and then brought down to the focal point that the genes for most life forms are very similar. Allman reports that this similarity leads scientists to conclude that all life forms came from a common ancestor. This reference is included here to broaden the perspective of the potential of genetics to understand and improve life forms, to include the dog.

Andersen, Gary L., LTC. Letter to CPT Denzil F. Frost, 20 November 1989.

LTC Andersen describes the delineation in operation of the MWD Program, and accounts for some of the variation in the numbers of dogs procured, shipped and rejected. Estimates for the costs to train a MWD for a Patrol Dog (\$8-10,000.00); Patrol/Narcotic Dog (\$12-14,000.00); and Patrol/Explosive Dog (\$16-18,000.00) were also quoied using data

from the cost analysis study conducted by the Air Training Command (Burwell, Craig, Defense). LTC Andersen states that the number of dogs procured each year is totally dependent on the needs of the training branch. The total of 408 procured for Fiscal Year (FY) 89 is affected by the pool of untrained dogs kept in order to be more responsive to training demand. This pool of untrained dogs may fluctuate from 0 to 100. Other variables include a "double-blind study" conducted in FY 88 which caused an increase in the number of dogs needed for training, and the fact that since training takes from 1 to 6 months to complete, dogs may be counted in 2 FYs (bought in 1 FY but trained in the next FY). In addition, some dogs may be kept for up to 3 years as training aids for new handlers. LTC Andersen also notes a definite improvement in the quality of dogs coming from Europe, as compared to state-side procured dogs. He attributes this to their prior training and aggressiveness. As a result, the success rate should be higher. Currently over 2/3 of the European imports are Belgian Malinois (Jennings). The other 1/3 is composed of German Shepherds. The Belgian Malinois is favored as it is deemed to be more intelligent and aggressive (Jennings). LTC Andersen also comments on the washout rate, which in FY 88 was 21 per cent. For FY 89 the rate has gone down to 16 per cent. He also mentioned, however, that the washout rate was approximately 5 per cent during the late 70's. He lists the following characteristics that frequently lead to a dog washing out: underaggressiveness, overaggressiveness, building shyness, fearbiting, and gunshyness. With respect to the ability of the training program to expand, LTC Andersen mentioned that the current capacity of the DODDC is 321 kennels. There is a Lackland Training Annex that has 353 kennels.

for dogs in training and for training aids. Any additional dogs would be staked out in the open with only a crate for protection. He concluded that this would be very undesirable. He also mentioned other limiting factors that should be considered in an assessment of the expansion capability of the training program. Those were: vehicle support, trainers, facilities (warehouses, barracks, and aircraft) that would be required for detection training. He concludes that it would be difficult to compare the success rates between the European imports and domestic dogs that undergo training because so few domestic dogs are procured anymore.Ω

Andersen, Gary, LTC. Telephone interview, 28 November 1989. LTC

Andersen stated that the rejection rate at procurement of MWDs is approximately 50 per cent, due to medical problems (primarily hip dysplasia). The washout rate for a patrol dog is about 16 per cent. He also mentioned that this rate used to be 5 per cent in the 70's. He did not know why the rejection rates were higher today, since the quality of the dogs is better. He said that it could be that not enough time is spent trying to get the "slower" dogs to pass the training course (Frost, Parks). He said he felt the high rejection rate was one reason for the large backlog of requisitions. He also said there are adequate numbers of trainers, but there is no apparent formalized certification process. When asked about command and control of the MWD Program, LTC Andersen said he understood it, but it was very confusing to people outside the program, and that it is largely ineffective in function since there is no one central manager for all facets of the MWD Program (Burwell, Parks, Stamp).Ω

Animal Behavior. Symposium on Animal Behavior. The Veterinary Clinics of North America - Small Animal Practice. Victoria L. Voith and Peter L. Borchelt, Guest eds. 12 (November, 1982). As expressed in the title, this is a compilation of papers presented as a symposium to further the understanding of animal behavior. The majority of the material comes from actual case studies, intermingled with accepted principles of etiology and therapeutics.

Archer, Caleb. "An Historical Review of the Military Dog." Military Police Journal (May 1966): 4-6. This article reviews the use of dogs in war up through the Vietnam War, and then describes the uses of working dogs in city and state police departments.

Army-Air Force Center for Low Intensity Conflict. "Military Working Dogs in Low Intensity Conflict." This briefing documents the performance of MWDs in previous military conflicts and demonstrates the capability of the MWD to meet the expanded roles required under the conditions of low intensity conflict (Thorton).

Arner, L. D., H. Master, G. R. Johnson, and H. S. Skovronek. "Delineating Toxic Areas by Canine Olfaction." Journal of Hazardous Materials 13(1986): 375-381. This article describes the feasibility of using dogs to detect toxic pollutants in a field environment. A discussion of the selection and training of dogs to detect very small airborne concentrations of hazardous chemicals in the field under varying weather conditions is also included.

Arthur Billy A. "Russian Mine Dogs." EURARMY (December 1981): 5. This brief article describes the Russian use of dogs to destroy Nazi tanks.

Arts and Entertainment Network Premieres. Animals in War. 16 March 1990. This television feature reviews the various ways man has used animal conscripts to help him fight his wars, to include birds as messengers, elephants to plow German fields during World War II, dogs as message carriers, mine detection, search and rescue, paratroop missions (parapooches) and Soviet tank destroyers, seals as Swedish submarine hunters and killers, and animals that are used in research to enhance combat power and treat the wounded. All U.S. dogs that were donated by private citizens during World War II had to go through rehabilitation school and learn how to play and have fun prior to returning to their owners. The program also emphasizes that dogs, and other animals are far from obsolete in modern warfare. The U.S. and Soviet Navies use of dolphins and whales is discussed, as is the Swiss Army's use of more than 30,000 pigeons intended as message carriers in the event of a nuclear explosion that would play havoc with electronic communication equipment. These birds are also reported in the program to be used for undercover work, since they are difficult to detect, reproduce readily and are easily trained. Various nations are also using the dove of peace to follow laser beams to their source and deliver explosives.

Ash, Edward C. Dogs: Their History and Development. Vols I & II. New York: Benjamin Blom, Inc., 1972. This book gives a detailed account, by breed, of how the different breeds of dogs have developed over time. Much of this development occurred during the Middle Ages.

Ashton, E. H. and J. T. Eayers. "Detection of Hidden Objects by Dogs". Copy of the report was obtained from Dr. Jeffrey Linn. This report addresses the

accepted ways that dogs are used to detect hidden objects, and attempts to assess to what extent a dog can be relied upon to detect mines. The authors cite the use of dogs to detect fish under rocks as a possible clue to additional sensory capability possessed by the dog. The end of the article contains a discussion session in which the dog's infrared sensory capability, and the possibility of mechanoreceptors in the feet are explored. It was further stated that the dog's capability to detect hidden objects in the desert falls off markedly, almost to the point of chance (Fenton; Mueller, Larry; Syrotuck).

Author Unknown. "Army Dogs - Spanish Army". Spanish Army Review - 1985. The author received a copy from Dr. Jeffrey Linn. This article reviews the usefulness of the dog in war throughout history and then describes the development of training centers for dogs in Spain. The Spanish also prefer the German Shepherd, 2-3 years of age. Training lasts approximately 3 months.

Author Unknown. "Proposed Army Canine Remount System." Obtained from Dr. Jeffrey Linn. This Staff Study presents 3 alternatives, 1) To distribute excess biosensor dogs to civilians, 2) To invite civilians to breed their bitches to biosensor studs, or 3) To distribute excess biosensor stud dogs to selected post veterinary facilities and invite local breeders to mate their bitches to them. Advantages and disadvantages were presented for each alternative. Alternative 3 was recommended.

Author Unknown. "Soviet Dogs vs German Tanks." Army Museum Newsletter 21(February 1982): 30-34. This article provides detail in content, drawings, and photographs to describe the use of dogs to destroy German

tanks. The author suggests that this technique was less successful when the Russians took to the offense because of the difference in fuel used to operate the tanks. The Russians used diesel and the Germans used gasoline. The article also says the dogs became less effective once the German commanders told their troops that the Russian dogs had rabies. This resulted in the indiscriminate shooting of all dogs found on the battlefield.

Author Unknown. "War Dogs." Military Review, XXXIII (1953): 57-62. This paper reviews the history of dogs in war and provides data about their effectiveness during the Korean War.

Author Unknown, "What Do You Get If You Cross...?" The Economist, 15 (August 1987): 67-69. This article reviews the different techniques and technologies available to use genetics to improve life forms and benefit man. Embryo transfer, cloning, embryo splitting, transgenesis and chimeric rescue are some of the topics discussed. This article is included in order to stimulate future conceptual implications for genetic improvement in the dog.

Bell, Jim. Telephone interview with Denzil F. Frost, 27 February 1990. Mr. Bell stated that most of the Marshall Farms clients are pharmaceutical companies who do research on dogs that may be dosed daily for months, and in some cases for years. For this reason, he stated that they select primarily for a calm dog, one that can handle a lot of stress. He said the best way to do this is through breeding (temperament) and socialization. When the pups are 6 weeks old they begin to be handled on a daily basis until 9 weeks of age. After that time the pups only have daily contact with the personnel cleaning the kennels. At 4 months of age, the pups

are evaluated in the pen, in someone's arms, and on a metal table. He said that the ideal time to do this evaluation would be at 8-9 months of age, but most of their dogs are sold when they are 4-5 months old. Those that are kept for breeding are reevaluated at 8-9 months. They use a computerized outbreeding system to produce their dogs. Mr. Ball said they do not select parents with a specific offspring in mind. They have been breeding beagles at Marshall Farms for more than 20 years. They maintain a colony size around 14,000 dogs. When asked about the potential implications of the USDA regulations, Mr. Ball said the requirements for each dog to have 80 feet of cage space, and to be exercised 1/2 hour per day is totally unrealistic. He said it would take 1/2 the county just to exercise the dogs each day.Q

Ballantine, David S., Jr., Susan L. Rose, Jan W. Grate and Hank Wohltjen.

"Correlation of Surface Acoustic Wave Device Coating Responses With Solubility Properties and Chemical Structure Using Pattern Recognition." Analytical Chemistry, 58 (1986): 3058-3066. This paper demonstrates the importance of the solubility properties for determining the responses of surface acoustic wave (SAW) sensors. Sensitivity and selectivity of the absorbant coating applied to the piezoelectric crystal is demonstrated to be critical to the overall performance of the sensor. This study provides a large data base of responses from 12 different coatings to 11 vapors at different concentrations. The data was analyzed using pattern recognition techniques in order to evaluate vapor/coating interactions. The paper concluded that in order for a sensor system to be effective for selectivity and sensitivity, multiple

sensor arrays of coated SAW sensors are required with appropriate software to provide pattern recognition capability.

Barnes, Deborah M. "Bird Brain Switch Leads to New Song." Science, 242(September 1988): 1434-1435. This article discusses the use of brain grafts and labeling with retroviruses as new and powerful tools for examining and understanding the origins of behavior and the sequence of brain development. The story behind the title of the article relates to an experiment where part of the brain of a quail embryo was transplanted into a chicken embryo. Upon hatching the recipient chick made the sounds of a quail chick. The article presents comments from researchers around the world who conclude that these observations will greatly assist in research designed to understand brain development and consequent behavior patterns. Barnes also states that retrovirus is being used as a marker to assist scientists map the development of the brain.

Beaver, Bonnie V. Letter to CPT Denzil F. Frost, 24 October 1898. Dr.

Beaver mentions that she and co-investigator, Dr. Jo Ann Eurell (University of Illinois) just started a study to attempt to quantify canine behavior, but data will not be available for another few years. She mentioned that little additional work on canine socialization has been investigated in addition to that reported by Scott and Fuller. She says Scott and Fuller's work is regarded as outstanding, and it would be very expensive to repeat. She referred the author to the article by Fält and Wilsson and Pfaffenberger's book. She also suggested that the author contact Dr. George Lees, who had experience working on the biosensor program.Ω

Bell, Trudy E. "Bombshell For Dogs." IEEE Spectrum June 1987: 20. This brief article announces the development of a device that is expected to be more efficient than the dog at detecting and identifying explosives. The article claims the device can detect up to 1 part per billion within one second. The article then proposes several advantages of this device over the dog. The device is claimed to be able to detect and identify several different classes of explosives, and states that dogs are usually trained to identify only one (Author's Note: This seems to contradict the information received from others, such as Craig, Fenton, Frost, Kay and Parks). The other proposed advantages of this device relate to its ability to operate all of the time, whereas the dog is subject to fatigue. In addition, the article compares the cost of the device (\$75,000.00) to be equivalent to the cost of training an explosive detector dog (Author's Note: This also seems to contradict information received from Andersen, Drexler, Kay, Reaver, Sexton). Never the less, the article illustrates the competitive drive that exists to satisfy the increased demand for responsive identification of not only explosives, but also illicit narcotics.

Berg, Irwin A. "Development of Behavior: The Micturition Pattern in the Dog." Journal of Experimental Psychology 34(1944): 343-368. This study illustrates the multifactorial components of behavioral study and interpretation. Berg states that canine micturition patterns develop in a cephalocaudal direction and that leg elevation appeared to be sequential to the proximo-distal pattern, and did not develop until several months after locomotor development was almost complete and the animals began to walk in a digitigrade manner. Berg identifies 3 distinct stages of

leg elevation. Stimuli, such as fear, caused a regression in the puppy posture at urination. Berg attributed testosterone as the primary factor that facilitates and sustains the leg raising behavior in male dogs. He noted little distinction in the urination postures of male and female puppies. When comparing castrated littermates to intact siblings, Berg noticed an absence of leg elevation in the castrates, which commenced elevation of the leg when injected with an exogenous source of testosterone. The injection of testosterone into females caused marked leg elevations during micturition, some raising their legs more than 100 times in 1 hour. The injection of female hormone into males demonstrated a disruption in the leg elevation patterns of the male dogs. Berg concludes that his data suggests the existence of a sensory motor mechanism that is activated by varying thresholds and that leg elevation is not learned.

Bernhardt, Todd. "Canine Class." Police 11(1987): 35-39, 64-65. This article provides a lot of detail concerning the Alabama Canine Law Enforcement Officers Training Center, and its philosophy of using the West German training techniques that are based on research. General descriptions of the methods and research are included.

Bernhardt, Todd. "From Infamy to Admiration." Police (January 1989): 37-41. This article traces the public image of police dogs from World War II to the present. Bernhardt states that the low point occurred during the riots of the 1960's. The author presents the view that the police working dog's role has changed from only bite and chase to the expansion of a wide range of missions that better utilize the dog's capabilities. This in turn has required the refinement of training techniques. The

author predicts that the combination of decreasing funds and the existence or potential for expanding missions will add to the demand for working dogs. The article then ends with a description of the Alabama Canine Law Enforcement Officers Training Center, (ACLEOTC) and state the center is working to meet the needs of 3 new trends in service dog use. Those trends are accelerant detection, tactical dogs and human scent identification. The article states that ACLEOTC is the official U.S. representative to the International Police Dog Conference, and as such is privy to the cutting edge of world-wide efforts in research and training (Sexton).

Bickel, Carl. Letter to CPT Denzil F. Frost, 20 December 1989. This letter contained an information packet depicting the services offered by the National Criminal Justice Reference Service. Included also was a topical search on police dogs. This topical search contained 30 abstracts of articles from police and justice literature. Also included was a sample of NIJ Reports. This is a bimonthly journal of the National Institute of Justice.

Biddle, Wayne. "Terrorism in a Technological World." Discover June 1986:21-31. This article reviews the unique requirements of the terrorists to fulfill their purposes. Simplicity is paramount to the terrorist, and as such there will always be more options available to the terrorist than there will be ways to defend against them. Biddle reviews the technology available to detect new explosives such as RDX. The vapor pressure for this explosive approximates 1 part per trillion. Dogs are not discussed in this article.

Bielfelt, Sherman W. Letter to CPT Denzi! F. Frost, 2 January 1990. Mr.

Bielfelt states that he feels there are behavioral traits that can be genetically selected. He also mentions that it is not uncommon to find close relatives with similar rejection patterns, and that there are so many behavioral reasons for rejection that they have put them together into an index at Guide Dogs for the Blind. He makes the point that although an individual dog may be selected or rejected for specific reasons, such as over aggressiveness, insecurity, and the inability to take responsibility, the underlying genetics for any category is generally not clear and a large number of categories can make selection chaotic unless some effort is made to consolidate and simplify. Referencing the data presented in Guide Dogs for the Blind: Their Selection, Development, and Training, it appears that some non-genetic factors also play a role in selecting for specific conditions such as hip dysplasia. He also quotes from Scott and Fuller's book, Genetics and Social Behavior of the Dog, p. 403 that "behavioral characteristics cannot be developed to a high degree" are referring to the wolf in the wild, a free-living situation, as opposed to a dog in a domestic situation. Compared to the wolf, Bielfelt says the dog is a specialist, and in becoming a specialist the dog has lost the ability to compete with the wolf in the wild. The dog's speciality is dependent on man and the process of domestication (Budiansky: 76). As such he says the dog could return to the wild with the absence of wolves or other feral animals occupying the same ecological niche.

Mr. Bielfelt spends considerable time discussing the advantages, disadvantages and methods of application of linebreeding, inbreeding and outbreeding. He states that regardless of the method there will always

be sur - es. With intense inbreeding one can expect fertility problems. The application of 100 per cent outbreeding will result in the gene pool being swamped by whatever genes are being brought into the gene pool at that moment. The general approach used at Guide Dogs for the Blind is a nearly closed gene pool with modest inbreeding. The disadvantage to this method is a deleterious accumulation of inbreeding because the gene pool is so small. They try to avoid or prevent this by accepting a few, usually donated dogs, and will screen breeding candidates from outside sources in order to keep open the possibility of: 1) Obtaining desirable genes not presently in the colony, and 2) Slowing down the effects of accumulated inbreeding. He likes to see about 10 per cent of the gene pool represented by outside genes. Bielfelt equates this to the inflow of genes from outside sources to be likely at a level of 2-3 per cent of the gene pool per generation.

The selection process is comprised of 2 major components: 1) An update of both the behavioral and physical indexes for all breeding stock, make a rating for all litters of pups currently being raised in the 4-H homes, and make recommendations as to what litters should be considered for providing breeding stock. 2) The training staff observes the animals in the litters that have been recommended by Bielfelt, as well as dogs from other sources (usually donated animals).

The length of time required to set up a breeding program depends on the resources devoted to it, and the product you hope to get out of the program i.e. an 8 week old pup or a 12 month young adult. He cautions to plan on an estimated 7 month interval between estrous cycles, and a 2 month gestation period. Selection of the initial stock would also

take time. He states that the rapidity with which selection gains can be made are related to: 1) The heritability (traits of higher heritability will respond more rapidly; behavioral traits probably have low heritabilities in general), and 2) the number of traits for which you are selecting (the more traits selected for the slower the progress). In general, Bielfelt says selection of a single trait is a mistake because the colony will break up due to the resulting weakness at other traits, be it reproduction, physical or behavioral problems.

Concerning artificial insemination, it may increase the reproductive ability of the bitch and more rapid selection by having more offspring from desirable bitches, but he warns that the hidden cost could be more rapid inbreeding in the colony. He concludes by saying, "To set up a breeding program, one needs some degree of resources, some degree of time, some idea of where one wants to go and some idea of how the end product will be used."Ω

Biosensor Systems. Progress Reports. 1968 thru 1975. In possession of the author. For more complete information Dr. Jeffrey Linn should be contacted. These reports review the progress made during the 8 year study to accomplish the objective of developing a more intelligent and sensually acute dog that would be better suited physically and temperamentally to accomplish military missions. Each report follows the format of objective description/background, progress/approach, summary/presentations, and conclusions/recommendations. Line breeding coupled with progeny testing of each generation was the specific mode for achieving the objective. Evaluation procedures were developed referencing military working dog requirements and principles

described by Pfaffenberger. Socialization and evaluation began on the 6th week of life and continued until 10 months of age, at which time advanced evaluation began and continued until 12 months of age. Animals that did exceptionally well throughout all phases were kept as breeding stock. On the average 225 to 250 dogs were maintained at any one time. There were 20 whelping wards that were temperature and humidity controlled. Radiographs of the hips and elbows of each pup were taken at 5, 8 and 11 months of age for examination of hip and elbow dysplasia. The Fiscal Year (FY 72) Report mentions that following a visit to the research facility, the Australian Army began their own breeding program and called their project the "Psychogenetic Breeding Programme." (see Goddard) In FY 73 a new project was initiated that was designed to identify pups with exceptional olfactory capability to detect explosives. Pups (116) from 20 litters were exposed twice weekly (5 to 10 minutes) to dynamite, beginning at 8 weeks of age through the 14th week of age.

In this same report, the observation is recorded that there was a concomitant increase in hip dysplasia among the progeny of the parents and increased selection pressure was exerted on the parents for overall temperament improvement. The decision was also made during this year to transfer breeding stock to some of the Using Agencies, and the Seeing Eye Corporation. The discussion included the observation that the U.S. Air Force would be the logical site to establish a canine remount service for the military. The FY 74 report mentions the employment of statistics to evaluate efficacy of selection criteria used to predict which pups had the greatest potential as successful MWDs.

In FY 75 a special 'socialization section' was established to evaluate the pups under different situations depicting every day activity around people. Examples include taking the pups to the Child Care Center at Edgewood Arsenal to let the children, whose parents had given consent, play with the pups. Other situations involved exposing the pups to crowds, and congested areas. Numerous articles were published relating to the scientific progress of the study. However the program was terminated in June of 1976 (Author's Note: Refer to Gilbert for the official reasons of termination; Fuller, Lees, Linn, News Release).

Bodingbauer, Joseph. Wesensanalyse für Junghunde [Character Analysis of the Young Dog]. Wein: Eugen Ketterl, 1969. This book discusses how to evaluate the temperaments of juvenile dogs (Fuller).

Bloomberg, Mark S. "Hip Dysplasia, What's Old! What's New! What's True!" 1989 Short Course on Military Veterinary Medicine. Washington, D. C., 3-7 April 1989. Dr. Bloomberg describes the incidence, etiology, pathogenesis, clinical diagnosis, radiographic diagnosis and treatment options of hip dysplasia. He also provides an excellent source of references on the topic.

Bowen, Richard. Letter to CPT Frost, 11 December 1989. Dr. Bowen enclosed with the letter a photocopy of a review on frozen semen, entitled, "Update on Freezing Canine Semen" (Smith, Frances). Dr. Bowen stated that this information may be a bit old, but as far as he knew the state-of-the-art has not advanced much beyond what is mentioned in the referenced article. The article reports that due to the difficulty of cervical cannulation, normal conception rates (66-83 per cent) can only be achieved via uterine surgical insemination. The paper concludes that

cryopreservation can be relied on as a practical reality, but the major obstacle blocking attainment of normal conception rates via artificial insemination is the cervix. The paper also mentions that the American Kennel Association (AKC) recognizes litters produced from frozen canine semen, and that there are 10 AKC-approved facilities for freezing canine semen in the United States (Concannon, Mathews).Ω

Bracken, Jane L. Letter to CPT Denzil F. Frost, 10 January 1990. This letter contained a press kit of information about International Guiding Eyes, Inc., and a sample of the organization's magazine entitled, Partners, and their newsletter IGE News.Ω

Brannaka, D.C. Letter to CPT Denzil F. Frost, 26 March 1990. Mr. Brannaka states in his letter that he initiated the pilot training program for USDA-APHIS in June of 1987. The mission of these dogs was to prevent the entry of foreign pests and animal disease risks into the United States. This was to be accomplished by the dogs checking passengers and international baggage for prohibited fruit, plant and meat items. He states that the work distractions are enormous, and the dogs must be highly discriminative since other food items allowed entry into the U.S. are frequently found with the target items. From 1984 to 1986 he says that APHIS obtained their dogs from the DODDC, but he found "much to be lacking" and decided to start his own program (Author's Note: Mr. Brannaka did not provide specific reasons for his dissatisfaction with the DODDC, but did offer to participate in any way possible to improve the current MWD Program). Mr. Brannaka prefers the Beagle because this breed is readily accepted by the public as non-threatening (Dennis), it has good olfactory acuity, and it works well for food.Ω

Brey, Catherine F. and Lena F. Reed. The Complete Bloodhound. New York: Howell Book House, Inc. (1978). This book is the most comprehensive book reviewed by the author on Bloodhounds.

Brown, Hildegarde. Telephone interview, 28 November 1989. Mrs Brown said she felt that civilian training was much more sophisticated, and that during World War II, the Korean War, and the Vietnam War the dog and handler were always trained together. They are now trained separately. She also referred the author to Tom Mitchell who is the author of a book on Schutzhund. Ms. Brown said the training and discipline required of a Schutzhund trained dog compared to a regularly trained working dog is like comparing ballet to square dancing.Q

Bruno, Mary P. "An Economic Analysis of Manpower Alternatives for the Navy Drug Detector Dog Handler Function." Naval Postgraduate School, Monterey, California. DTIC Number ADA 132203. This thesis examines the economic factors considered to be critical in conducting such an analysis, and presents alternatives to the current system of employing the dog/handler team, and the potential problems associated with the alternatives. This thesis concluded that justification based on intrinsic military requirements was not sufficient to maintain military personnel in DOD handler positions, and that there were adequate civilian firms to provide the handler services at potentially lower costs.

Budiansky, Stephen. "The Ancient Contract." U.S. News and World Report (20 March 1989): 75-79. This article traces man's domestication of animals, with special emphasis on the dog, and then presents the emerging concept among archaeologists of the coevolution view of evolution. This thought pertains to the opinion that the animals who

underwent domestication benefited more than man. The author spends the remainder of the article explaining, or quoting scientists to illustrate and compare the benefits of domestic animals to their respective feral relatives.

Bunker, Sandra-Faith Jean Lamb, MAJ. "Benefits of the Competition in Contracting Act of 1984 and Subsequent Procurement Legislation." Diss. Command and General Staff College, 1986. ADB 106 143-4. This thesis describes the evolution of the Competition Act of 1984 and its advantages, discusses the role of the Competition Advocates General, and lists the disadvantages associated with extensive congressional oversight of defense acquisitions.

Burns, George W. The Science of Genetics - An Introduction To Heredity. 4th ed. New York: Macmillian Publishing Co., Inc., 1980. This text is included as a source for a basic understanding of the science of genetics at the university level.

Burns, James A. Letter to CPT Denzil F. Frost, 20 March 1990. Dr. Burns states that the foundation breeding stock for Ridgian Farms was purchased in 1967 from breeders who exhibited their dogs at conformation shows, and that they are still using the original lines. Selection criteria are based on temperament, production and conformation. Dr. Burns states that socialization is an ongoing process, but is most intense during the age period of 4 to 16 weeks. The specific methods of socialization were the same as those described in the Telephone Interview below. Also included with the letter was a schedule of procedures and vaccinations given from birth until shipping.Ω

Burns, James A. Telephone interview, 23 February 1990. Dr. Burns described the socialization process of Beagle pups at Ridgian Farms, Inc. He stated that they begin to handle and speak to the pups at 3 weeks of age. Also during this time they begin to introduce food mixed with warm water. At 6 weeks of age they are weighed once a week until they are 16 weeks old. They are weaned at 7 weeks of age. After weaning the pups are kept 2-3 to a cage until they are 4 months old. At that time they are housed separately in cages from which they can see other dogs. He said the keys to their socialization program was to touch and talk. He also discussed the potential impact of the proposed USDA regulations on research kennel operations such as Ridgian. Their primary concern with the new regulations centers around the requirement that each dog receive at least one half hour of exercise per day. He said they have, on the average, 2,500 dogs, which means it would take 8-10 people just to exercise the dogs each day. He said his company projects at least a 35 per cent increase in the price if and when the rules go into effect. He further added that last year was their best year, but this year there has been a significant drop in demand. His contacts with the research institutions state that they haven't had time to order dogs and conduct research because the new USDA rules pertaining to the research institutions have already gone into effect. Therefore, the researchers are spending all of their time revising study protocols and filling out the paperwork required by the Animal Use Committees. Q

Burns, Marca. The Genetics of the Dog. Edinburgh: Commonwealth Agricultural Bureau, 1952. This is a general introduction to the science of genetics in the dog. Burns states that traits such as trail barking,

head position while hunting, gun-shyness, sensitivity to touch and sound, relative intelligence, aggressiveness, tendency to carry objects in the mouth, should all be considered when selecting or producing a good working dog. He states that dogs that are medium sensitive to both sound and touch are the best workers, whereas those that are under sensitive prove to be the worst workers.

Burr, John R. Letter to CPT Denzil F. Frost, 27 February 1990. Dr. Burr divides his letter into the following categories: setup, maintenance and efficient use of a kennel, breeding and/or procurement of animals, socialization of dogs in the kennel and training of the colony members. Dr. Burr states that prior to kennel design or construction, the following question must be answered: What is the purpose of the kennel, such as research, propagation housing, or multipurpose? Once the primary design has been identified the next step is the design of the building. Unique requirements of building design related to the purpose include shower-in and shower-out facilities for a breeding facility that is maintained as a closed colony, along with a quarantine area, whelping rooms, and a surgical suite to handle dystocias. Dr. Burr mentions several features for any kennel that in his experience have proven very helpful. They include: outside drainage, sloped flooring, rounded edges and corners, water and pressure-resistant surfaces, 10 to 15 air changes per hour, adequate feeding and resting areas that decrease competitive eating and anxiety, backup systems for at least water supply, a dip tank, and a natural barrier surrounding the entire kennel to decrease encroachment of ectoparasites. He mentions that climatic changes and topographic

characteristics may dictate other specific factors that need to be included in the kennel design.

Once the kennel is designed, Dr. Burr states that there are basically 2 methods to populate a kennel: in-house breeding or outside procurement. Each method, he states, has its own special requirements. For example, a breeding kennel will require whelping rooms and the capability to handle paraparturient problems and neonatal abnormalities. He also mentions the need to purchase periodic breeding stock from outside the colony in order to diminish in-breeding (Bielfelt). The trade-offs of outside procurement include money and resources saved in building design and support services, but the selection of the breeder and animal selection become much more important. He stresses temperament and conformation as being important criteria that cannot be over-looked or minimized. He states that the extent of temperament testing should be dictated by the use of the animals, and that all evaluations should follow a standardized protocol.

With respect to actual breeding methods, Dr. Burr prefers natural breeding since estrus detection and artificial insemination are not as successful or efficient. Although he also mentioned that he does use a combination of natural breeding and artificial insemination.

Dr. Burr discusses socialization in 2 phases that he classifies as species-specific socialization, and inter-species socialization.

Species-specific socialization is defined by Dr. Burr as the natural interaction and behavior between puppies in a litter. He feels this is very important for proper assimilation into the colony. Dr. Burr defines inter-species socialization as the contact of the pups with humans. He

states that this interaction should begin at 3 - 4 months of age and should be limited to easy tasks such as leash walking and learning basic commands (sit, stay, and come).

He states that more demanding training may begin at 4 months of age or wait until the pups are 6 months old. Dr. Burr states that physical examinations should be performed quarterly, using the Problem-Oriented Medical Records System. In his opinion, being able to place all records on a computer system is the most efficient method of maintaining records. He admits that he is biased on his views of nutrition, but states that the nutritional support is very important. In a kennel environment he does not feel that free-choice feeding is practical, and that meal feeding is more efficient in manpower needs and time. Automatic bowl washers are also very helpful.Ω

Burwell, Tom, Maj. "Systems Analysis of the Military Working Dog Program." HQ ATC/XPCO, Command Analysis Division. This analysis entails an evaluation of the program manager (AFOSP), logistics function (AFLC), veterinary function (Army), and the training function (ATC). The background information contains a very descriptive flow diagram of dogs from procurement through certification. This diagram can also be seen in Appendix G. The analysis states that many problems were found. The major conclusions were as follows: 1) The excessive backlog of requisitions was due to a failure to train sufficient dogs. This has resulted in a 4 year backlog of requisitions for Patrol/Drug dogs. 2) The animal behaviorist was involved only with training and had no accountability for the screening process and the procurement of the dogs. 3) At present, the dog will continue to be the best detection method

available. The report addresses the technology status and describes predicted trends. 4) There is no focal point for daily operations. 5) A good dog can compensate for a poor handler, but a good handler cannot compensate for a poor dog. 6) A surge in the number of dogs will occur during the next 18 months, which will only aggravate the current handler/dog/MILSTRIP mismatch.

Currently an average of 37 dogs are procured each month. The report predicts that as a result of the surge, 94 dogs will need to be procured each month (a total of 1,692 will be required to accommodate the anticipated surge). Additional conclusions are: 7) The possibility of obtaining fully trained dogs from European sources is questionable. 8) The average time, in days, required to train a Patrol, Drug or Explosive Dog has a large variation (standard deviation). For example, the average training days for each of the dogs described in the preceding sentence, and the accompanying standard deviations are 27.1 ± 18.8 , 44.1 ± 17.7 , and 59.9 ± 23.1 , respectively (Andersen; Noll; Reaver; Schwartz, Taylor, E). 9) As the quality of the dogs increases concomitant to an increase in the procurement standards, the rejection rates remain the same. 10) The price charged to the Using Agencies should reflect the actual costs. Currently, the Using Agencies are charged \$1,468.00, regardless of the type of dog purchased. As a result, if given the choice between a Patrol dog or a Patrol/Explosive dog the Using Agency will naturally choose the most product for the dollar spent. The report calculates the actual total cost for a Patrol, Patrol/Drug and a Patrol/Explosive dog to be \$6,772.00, \$9,050.00, and \$11,054.00, respectively. 11) Currently the MWD Program has more manpower than ever before, and yet fewer dogs

are being trained. 12) DOD Directive 5200.31 needs to be amended. 13) Sufficient data was not available to justify the decision to switch from the German Shepherd to the Belgian Malinois. Currently the Belgian Malinois makes up 75 per cent of the total procurement, and 44 per cent of the problems are associated with this breed (Jennings). Three alternative solutions were discussed in the report. They were, purchase mechanical devices for substance detection, purchase fully-trained dogs from vendors, and fix the present system. As mentioned above, the report concluded that the dog will continue to be the best detection method available, and that it was questionable whether overseas vendors could supply the numbers of fully-trained MWDs required. The recommendations of the report were to: 1) Decrease the production surge in order to minimize waste. 2) Identify ATC as single manager for all aspects of the MWD Program, including funding. 3) Form an implementation team whose primary objective would be to reorganize the MWD Program into 6 divisions in order to match training to MILSTRIP requirements (McIntosh, A Review.).

The recommended divisions were: Research and Development, Logistics, Training, Veterinary Medicine, Services, and Operations. The report goes on to list intended activities that would pertain to each division. The activities to be associated with the Research and Development Division include the development of dog power standards, research in breed selection, development of a training policy and research devoted to determining the feasibility establishing a breeding MWD kennel. The intent of the breeding kennel is to produce a high quality dog and sever the dependence on a foreign source for dogs. Currently 98 per cent of all

dogs procured for the MWD Program come from Europe. The report stressed that this project would require the commitment of all of the Using Agencies. The responsibilities intended for the Logistics Division would include procurement, evaluation and screening, transportation, and support operations. The Training Division would be responsible for training the dogs and the handlers. The report emphasizes that handler training and the training of the dogs are "inextricably linked." The report further states that the MWD Program has the only known training system that trains the dog and the handler separately. The Veterinary Division will be responsible for medical services and animal behavior. The report suggests that a seminar be organized, and invitations be extended to experts on animal behavior in the civilian community. The Service Division responsibilities would include the monitoring of feedback from the MWD handlers, management of the MWD inventory, billing for MWDs, and sales/donations of MWDs who wash out of the training program. Feedback from the MWD handlers would be in the form of training quality, and dog training quality reports. The Operations Division would be responsible for monitoring the operations of all of the divisions, project procurement requirements against inventory requirements, monitor manpower, establish the budget and maintain accounts, update costing of MWDs, and develop a production plan.Q

Buytendijk, F. J. The Mind of a Dog. Boston: Houghton Mifflin, 1936. This book discusses canine behavior, to include instincts, expressive movements and barks showing emotion and other psychological states, sense perceptions, olfaction, tracking, the perception of form and the role of visual cues, hearing, seeking and "reasoning." Buytendijk states

that anyone working with a dog must, above all else, realize that the dog is a smelling animal, and that its actions are primarily governed by that faculty. Man views/perceives his world through sight; the dog's main perception is by smell. Buytendijk states that it is paramount to keep this difference in mind at all times, whether one is conducting research on or training a dog.

Cain, William S., J. Russell Mason and Thomas H. Morton. "Use of Animals For Selection of Land mines and Other Explosives: A Review and Critique of Prospectus." Sponsored by U.S. Army Mobility Research and Development Command, Under U.S. Army Contract DAAK 70-84-K-008. This report evaluates the literature (date not indicated) concerning the use of animal olfaction to locate hidden objects, and discusses the limitation in understanding what specific cues animals use for detection. Numerous experiments are proposed to expand this understanding.

Canine International Genetics, Inc. Training Manual. This manual depicts staff and consultants of the organization, ICG technology, breeding services overview and canine ovulation timing instructions (Rankin).Ω

Canine International Genetics, Inc. Training Manual, Fresh Chilled Semen Breeding. This manual describes general responsibilities, semen collection - general, performing collections - extending semen, semen analysis, artificial insemination - general, timing procedures and indications, and performing inseminations (Rankin).Ω

Caldwell, Charles G. Letter to CPT Denzil F. Frost, 17 January 1990. Mr. Caldwell states in the letter that the U.S. Customs Service (USC) procures all of their dogs from animal shelters and humane societies

across the country. He says the advantages to this method of procurement include the following:

- 1) A constant and readily available source of animals.
- 2) Good public relations because they are giving dogs a "new" life.
- 3) There is no loss in development time, i.e. the animals are mature and ready to undergo training.
- 4) Procurement costs are minimal.
- 5) Must examine, on the average, 45 dogs to find 1 suited for training (Fenton, Nixon). Mr. Caldwell states that this may be somewhat time consuming, but it greatly minimizes the rejections rates during training and significantly reduces operational costs. USC did not always procure this way. During the mid-70's, they accepted some of the breeding stock from the biosensor program and started their own breeding program. This program was discontinued for basically 2 reasons: The number of pups produced versus the number selected for training was very low. As a result the cost per dog was in the thousands of dollars. Manpower required for proper socialization was also intense. USC tried the foster home concept, but experienced difficulty finding homes, and many of the dogs that returned from homes showed signs of neglect. Today, USC utilizes Labrador Retrievers, Golden Retrievers, German Short Hair Pointers, and German Shepherds, or mixes thereof (Discover). The animals may be of either sex, and be between 1 and 3 years of age. Selection criteria center around an intense, almost fanatical drive to retrieve a thrown object. Other desirable characteristics include boldness, but not to the point of being aggressive toward people, high in "self right", feel secure in any area, and not be intimidated by strange

sounds or sights. USC trains both the dog and handler together. Caldwell says this teaches the handler the essentials of his profession and provides a sense of pride that the handler trained his own dog. Training evaluations occur during the 3rd, 9th and 12th week. Each team undergoes annual recertification. Mr. Caldwell stated that, in his opinion, the MWD Program is a fine program. He did state, however, that any problems they may be experiencing may be traced back to the loss of their experienced trainer and handler pool. He knows numerous trainers that had over 20 years experience each, who either retired or left for similar employment outside the military (Frost, Hayter, McEathron, Parks). Mr. Caldwell also enclosed samples of a puppy selection list, detector dog evaluation checklist, detector team performance evaluation, and a copy of a memorandum explaining why USC discontinued the breeding program.Ω

Campbell, William E. Behavior Problems in Dogs. Santa Barbara: American Veterinary Publications, Inc., 1975. Campbell draws from thousands of cases in order to compile a casebook that describes specific problems, their etiology and treatment. He emphasizes that his investigations into the behavior anomalies of the dog are clinical in nature. As a result, inference to controls was not possible. He attributes the progress made in understanding animal behavior to joint cooperation between the disciplines of psychology and physiology in order to fully comprehend the total behavior of an organism. As such, Campbell considers the etiology of each case from the perspective of both psychology and physiology.

Carroll, Thomas A. Letter to CPT Denzil F. Frost, 31 January 1990. Dr. Carroll regrettfully states that due to proprietary policies, he is

prohibited from sharing any information relating to breeding, training, or operational practices conducted by Hazelton Research Products, Inc. He did mention, however, that it would be far more economical to procure dogs from breeders who were already established, provided the military had the right of refusal.Ω

Catalog 102. Chemical Microsensors. Microsensor Systems, Incorporated.

This catalog is included to document the types, capability, and availability of different chemical microsensors.

Chao, Eugene T. "Olfaction in Dogs." Diss. Florida State University, 1977. A comprehensive chronological review of laboratory studies relating to olfaction in dogs. Controversial issues relating to the dog's olfactory capability are discussed and drawn together from various sources, to include the "Bowser Principle." The author admonishes all investigators who study canine olfaction to be aware of this principle at all times. The principle states that dogs will use any method possible to gain the reward. Therefore, the challenge for the investigator is to limit the dog's choices in order to objectively discriminate between the causes and effects of cues and rewards.

Checkland, Peter. Systems Thinking, Systems Practice. New York: John Wiley & Sons, 1988. Checkland presents in this book his General Systems Theory, that makes a distinction between closed and open systems. The central concept of his book is to design a system that connects a set of individual elements together to reflect the whole rather than the properties of the individual elements. Checkland then defines system thinking as the process of developing a concept of the outside by means of the concept system. For example, the science of Biology is not

reducible to simply chemistry and physics, but rather is an autonomous entity of science. In Veterinary Medicine we have a saying, "Not all patients read the books." Biological systems are not always predictable via application of the basic laws of science. This is Checkland's main point in the book, and the purpose of the book is to capture all the variation in what he calls System Movement.

An effective Systems Movement will capture all the observed variation inherent with specific subsystems, and take a systems approach to a specific problem in order to benefit or improve the whole. In other words, once the individual parts are organized within a system they are changed because of that organization, and they are also affected if they leave the system. The purpose of the system only becomes a reality once all of the parts are assembled and working properly, just as a living organism. The heart, brain, kidney, or any other individual organ cannot exist alone, and the overall system will suffer without that individual organ being part of the whole. Checkland presents this concept with varying models designed for any man-made system. This reference is included here to serve as a source for further evaluation into the MWD system to evaluate the effectiveness of the MWD Program as a whole, complete entity, to include the Using Agencies.

Clark, Ross D. and Joan R. Stainer. Medical and Genetic Aspects of Purebred Dogs. Edwardsville: Veterinary Medicine Publishing Company, 1983.

This book provides a comprehensive knowledge of specific medical problems and the unique peculiarities of 131 breeds of dogs, to include the German Shepherd and the Belgian Malinois, although the information on the Belgian Malinois is quite general (Author's Note: refer to Reaver

for a more practical perspective of this breed). This book also intends to present specific disorders in light of the known genetic components for each defect, either inherited, degenerative or malignant. The genetic dimension becomes a more dominant player as purebred lines develop and continue over an extended number of generations (Author's Note: refer to Bielfelt, Ginsburg, Leighton, and Scott for additional information and references).

Clark, William H. H., COL (Ret). Letter to CPT Denzil F. Frost, 22 August 1989. COL Clark enclosed the unpublished manuscript of a book he is writing, entitled, The History of the United States Army Veterinary Corps in Vietnam 1962-1973. The reference material for the book comes from End of Tour Reports, letters and cassette tape recordings of personal accounts relating the experiences of the Vietnam War. Detailed information about the utilization and unique situations confronting the MWD in Vietnam is also included.Ω

Clark, William H. H., COL (Ret). Telephone Interview, 26 October 1989. COL Clark stated that the peak number of MWDs supported in Vietnam was approximately 2,000.Ω

Clede, Bill. "Arson Dog." Law and Order 36 (July 1988): 40-42. This article describes the nation's first dog (Mattie) that is trained to assist with the investigation of fires suspected of arson. The article states that Mattie has numerous advantages over just the combination of man and hydrocarbon detectors. The dog greatly lowers the numbers of samples that have to be submitted to the lab for confirmation. Each sample costs approximately 150 dollars. Without the dog, it may take investigators a week or more to search the scene of a major fire. Mattie can do the

same job in 1 or 2 days. The article states that a machine is capable of detecting parts per million, but the lab has confirmed that Mattie's capability is much greater, and she has never given a false positive, which is a common problem with a machine. Mattie works with 3 handlers, 1 per week. She remains with the handler 24 hours a day, staying with the handler's family. Since the program began on 1 May 1986, Mattie has assisted in the investigation of 77 fires, that has resulting in 9 arrests and 2 convictions. The dog is trained to detect paint remover, lacquer thinner, charcoal lighter, paint thinner, kerosene, naptha, acetone, dry gas, heptone, gasoline, no. 2 fuel, diesel fuel, gum turpentine, Heritage Camp Oil, transmission fluid, octane, and jet A fuel. Mattie was trained using traditional Pavlovian conditioning (Kay), and is only fed when she makes a positive identification, which means she works a fire scene or undergoes training every day. The article says that the Labrador is the preferred breed because it was bred to detect the scent of fallen birds. The German Shepherd is also mentioned by the article to be just as capable, but was also bred to protect his master, and thus may become distracted due to the tendency to protect when the dog may think the handler is in danger.

Colle, D. Caroline. "Dogs in Research. For Man and Dog." Gazette (March 1989): 84-88. This article is include here because of a statement made about the number of dogs killed each year in humane societies and pounds throughout the United States. The figure was 13 million per year (Olsen). Combined Arms Center and Developmental Activity, and the Academy of Health Sciences, U.S. Army. "Expanded Use of Military Working Dogs (MWD) Council of Colonels After Action Report." 17 May 1989. The

purpose of the conference was to explore the capabilities of the MWD Program to absorb additional missions (expanded use). Current problems of the program, such as the inability to be responsive to the user's needs (backlog problem), and lack of clearly defined peacetime and wartime requirements by the Using Agencies were discussed. The conference also addressed current demands for doctrinal changes that are leading to expand the role of the MWD beyond a law enforcement mission. The history of the dog in past conflicts was reviewed, current procurement, inventory and training activities were also discussed. At present, 98 per cent of all dogs procured are coming from Europe. Training production was reported to be significantly below last year's level, which has caused the number of backlogs to increase to 485. Three hundred and forty of these requisitions are for Patrol-Narcotics Dogs (Burwell). Many of the representatives from the Using Agencies were doubtful about the DODDC's capability to meet demand. The need for using scientific principles in training and procurement, and the importance of establishing standardized training methods, certification and procurement criteria, and breed specifications were also discussed. Lessons learned from the biosensor program were also reviewed. Mention was given to the findings from the Defense Science Board that concluded that a biological sensor research center be established. Summarized conclusions of the May 89 conference included the following:

- 1) The current MWD Program cannot meet existing demands for dual-purpose dogs.
- 2) The Executive Agent does not acknowledge the needs to expand the role of the MWD from its traditional role.

- 3) Requirements pertaining to low intensity conflict were identified as being in the most urgent need of support from the MWD Program.
- 4) Representation from the Air Force Office of Security Police is required in order to obtain complete consensus.
- 5) Unity of effort within the MWD Program will facilitate successful operation at all levels.
- 6) Command and control of the MWD Program needs to be at a high enough level to adjust to contingency threats during both peace and war.
- 7) A single manager is needed to operate the entire DODDC.
- 8) An additional training facility may be needed for the expanded role missions.

Recommendations of the conference included the following:

- 1) Initiate doctrinal changes
- 2) Approve a feasibility study for a breeding program.
- 3) Identify proponent for the overall program, to include expanded use.
- 4) Proponent should develop a draft concept about expanded use.
- 5) Commence research and development programs to improve MWD survivability under different conditions of conflict.
- 6) Place all activities pertaining to the production of MWDs within 1 organization.

Concannon, P.W. and M. Battista. "Canine Semen Freezing and Artificial Insemination." Current Veterinary Therapy X "Small Animal Practice", Ed. Robert W. Kirk. W. B. Saunders, 1989: 1247-1259. This article discusses the current state-of-the-art of the topics listed in the title,

and contains a list of AKC-approved canine semen freezing facilities (Rankin).

Cooper, James COL. Letter to CPT Denzil F. Frost, 16 October 1989. COL Cooper informed the author of the existence of a video tape that describes the activities of the biosensor program, and that COL Michael Groves informed him that additional footage and written material is being kept at the Walter Reed Institute of Research (Lees, Linn).Ω

Cooper, Jilly. Animals in War. London: Linotron Garamond by Tradespools Ltd., 1983. This book relates stories about the use of animals during World Wars I and II. Pages 54-71 relate specifically to dogs. The book contains many photographs of dogs in action, from parachuting from a plane to laying telegraph wire (Arts and Entertainment Network, Harfield).

Coppinger, Raymond P. Letter to CPT Denzil F. Frost, 1 February 1990. Dr. Coppinger stresses in his letter that a breeding program should only be pursued if you have the experience, a good eye, and know what your goals are (Bielfelt, Fenton, Kay, Reaver). His work relates to the development of livestock guarding dogs. He travels all over the world examining different breeds of dogs for that specific purpose. He states that the advantages of a breeding program are that if you know what you are looking for, you can set goals for conformation and temperament. He recommended The Seeing Eye and Dr. Leighton as excellent sources of information on how to establish and operate a breeding program. Dr. Coppinger also stated that he would be willing to help in establishing the selection criteria for a good working dog in an operational program.Ω

Coulson, N. M. Memorandum For Record. 25 July 1986. Subject: K9 Bomb Detection Training Seminar. Sponsored by the University of Maryland and the International Association of Bomb Technicians and Investigators (IABTI). Organizations in attendance included State, County, University, and City Police, The Federal Bureau of Investigation and the State Fire Marshall. Each unit has its own methods and ideas for training and procuring, reward schemes, and breed preferences. The general consensus of the seminar was that the Bloodhound has a better endurance and a longer term of interest when compared to the German Shepherd. It states that if a dog always trains on a small amount of explosive, it may not cue on a larger amount.

Coulson, N. M. Information paper on Animals in Home Defense - United Kingdom. February 1987. Received from Dr. Jeffrey Linn. This paper identifies the use of animals in the protection of the United Kingdom.

Craig, Dan. Letter to CPT Denzil F. Frost, 6 October 1989. Dr. Craig emphasizes in his letter that whatever the direction taken to improve the MWD Program, the reasoning and evaluating criteria must be objective in order to facilitate comparison to other methodologies. He states that initiation of a breeding facility must have the proper personnel, to include a psychologist (experimental), psychologist (genetic), and a geneticist. In addition, he recommends that all of the operating instructions for socialization, training, and environmental enrichment programs need to be written down. Included also was a curriculum vitae on Dr. Craig. Q

Craig, Dan. Telephone interview, 5 December 1989. Dr. Craig said that all dogs procured for the MWD Program are bought for detector dogs, and

those that wash out are trained as patrol dogs. The primary predictors are the ability to hold a bite for 5 seconds and the ability to pass being agitated 5 separate times. The responses are recorded. He also mentioned that the dogs and the handlers are trained separately, and that they have plenty of trainers. He said a single-purpose trainer will usually have 3 dogs, while a dual-purpose trainer will only have 2. He also explained a new procedure for training explosive dogs that he hoped would result in fewer dogs washing out of the Explosives Dog training. He said that the rejection rate for Patrol/Explosive Dogs is 43 per cent, while that for Patrol/Drug Dogs is 29 per cent (Andersen; Burwell; McCathern, Telephone interview; Taylor,E.).Ω

Davis, Wayne. Letter to CPT Denzil F. Frost, 13 December 1989. This letter contained a description of courses offered at the West Virginia Canine College. Courses include the following: 1) 400 hour Professional Training (tuition = \$4,190.00), 2) 200 hour Advanced Professional Training (tuition = \$2,095.00), 3) 600 hour Narcotic Dog Detection, 4) 600 hour Police Patrol Dog Training. The student must provide his /her own dog (maximum of 2). Tuition figures for 3) and 4) were not quoted (Andersen, Burwell, Drexler, Sexton).Ω

Davola, Peter R. Letter to CPT Denzil F. Frost, 28 December 1989. This letter was sent upon the request of Mr. Don Slovik, National Secretary of The United States Police Canine Association, Inc., that SSG Davola responded to. SSG Davola states in his letter that he is the certification authority and Kennel Master for Headquarters TRADOC. He states that, in his opinion, Health Services Command should take over the MWD Program,

and that if anyone knows the strengths and weaknesses of the MWD program he does.Ω

Dean, Edward E. and Samuel John Tomlinson. "The Scientific Development of an Efficient Detector Dog Through Olfaction and Behavioral Modification." Proceedings of the International Symposium on the Analysis and Detection of Explosives, 29-31 March 1983, FBI Academy, Quantico, Virginia,: 451-459 This paper explains the progressive learning sequence to indicate recognition of a primary odorant. Additional research studies are discussed which further expand the dog's usefulness as an explosive or narcotic detector.

Defense Science Board/CUSD(A). Defense Science Board Summer Study 1987 on Detection and Neutralization of Illegal Drugs and Terrorist Devices. Office of the Under Secretary of Defense (A). DTIC AD-C042 256. The purpose of this study was to assess the use of innovative technologies that could be used for the detection and neutralization of terrorism and illegal drugs, and to estimate future trends in illicit drug trafficking and terrorism. One of the conclusions of the study was that greater use of dogs could be enhanced if we could learn how they smell and how we could improve their ability to smell. The study reported that approximately 4,000 dogs trained to detect drugs and explosives were in the field. The study estimated that it costs approximately 5,000 dollars to train a dog and approximately 80,000 dollars to maintain one (Andersen, Burwell, Drexler).

The study further referenced the dog's mobility, inherent, independent and aggressive search capability, and superior olfactory sense as being strong reasons for their employment in the war against drugs and

terrorism. Technology cannot, at this time, provide electromechanical sensors to carry out with efficiency the missions documented by the dog. Numerous concerns were also addressed in association with the use of dogs. These included, the lack of an adequate domestic source of dogs, the increasing cost of detector dogs due to the high rejection rates during training, and the ability of the dog to perform multi-purpose tasks. This last concern stems from reported observations in the field of the tendency of the dog to perform tasks not consistently used at a reduced efficiency. The study also reported that in order to maximize the full potential of the dog's olfactory capabilities we must learn the limits of olfaction and determine exactly what it is that the dog keys on when it detects an explosive or an illegal drug. The study states the existence of a lack of central direction, and that goals must be defined.

Dennis, S.J., Captain. Letter to CPT Denzil F. Frost, 10 April 1990. Captain Dennis states that the U.S. Coast Guard is currently considering the introduction of drug detector dogs into their law enforcement program. He explains that the primary problem with the use of dogs on ships is mobility. He states that a dog's mobility is greatly impeded by steep ladder-type stairs. He further states that smaller dogs are more reluctant to negotiate the stairs than larger dogs, but that the smaller dogs have greater access to the many small spaces found on a ship. Based on the successful training program of U.S. Customs (Caldwell), Captain Dennis states that breeding programs and appearance are secondary to quality training, development of the handler/dog bond, and the working enthusiasm of the dog. Captain Dennis also states that another primary concern of the U.S. Coast Guard is the admissibility of

evidence in a court of law that is obtained by the use of a dog (Weidel). He concludes that most civilian sources are not certified to give such evidence.

He also mentions that the Coast Guard wants to use dogs that project a minimum, historically perceived threat (E - neka, McDowell). He cites as an example the Golden Retriever instead of a German Shepherd or a Doberman Pinscher. Captain Dennis concludes his letter by expressing his concerns for dual-purpose dogs. He states that the selection procedures for handlers is different in the U.S. Coast Guard for Patrol Dogs versus Drug Dogs. As a result, the employment of a dual-purpose dog would necessitate a requirement of 2 handlers per dog, and he concludes that this would limit the bonding between the dog and the handler for a specific type of mission. He also expressed concern for a Patrol Dog to attack when the appropriate response would be to alert.Ω

Department of Defense Directive Number 5200.31. Single Manager for DOD

Military Working Dog Program. September 7, 1983. The policy statement of this directive is to operate a DOD MWD Program under a single manager and under uniform policy guidance. Responsibilities are delineated for the Deputy Under Secretary of Defense for Policy, Secretary of the Air Force, Secretary of the Army, Heads of DOD Components, and the Chairman of the Joint Chiefs of Staff, Air Force Program Manager and members of the Military Working Dog Committee.

Devaney, Mathew B. Letter to CPT Denzil F. Frost, December 1989. Mr.

Devaney explains the German philosophy concerning working dogs. The Germans acknowledge a distinct difference between human and dog psychology, which then implies a difference in the learning process.

Enclosed with the letter was a list of "drives and character traits", that include the following: stable character, retrieve drive, perseverance, water conflict, food conflict, hunting drive, and handler/object conflict. Devaney states that it is critical that an evaluator understand these drives and how they are manifested in the behavior of different dogs. He states that the tests are extensive, but can be completed by a dog with the desired drives, which will in turn allow for better predictability under stressful field conditions. Devaney equates these drives to be reflective of a dog's true drive which is determined by genetics. In other words, it is the dog's genetic drives that will allow him to perform under stressful conditions. He illustrates this point by giving a scenario where the dog's life is threatened, and concludes that the dog will rely on his genetic drives and not on what he was trained (Deveney, Fenton, Kay, Parks, Rimbey). Devaney's experience is that these drives can be selected for through carefully designed exercises that enhance or expose the drives desired. The end result is a more reliable working dog, and lower "wash-out rates." The letter further relates new research being conducted by the Germans with respect to human scent and accelerant detection in incorporation of dog/handler teams into SWAT operations. Although this program is still in the experimental stages, the Germans expect to be able to train dogs to pre-scented objects and have the dog conduct scent checks of suspects in a lineup. This capability can also be used in arson investigations using discarded objects, in addition to the detection of accelerants at a suspected arson site. Q

Dinc, Hattie I. "The Role of the Olfactory System in the Detection of Ionizing Radiation by the Rat." Diss. Florida State University, 1987.

This study examines the different sensitivity roles of the peripheral and central components of the rat olfactory system to detect changes in ionizing radiation. This reference is included here to stimulate further research into examining the possible utility of employing dogs, or other biosensors on a battlefield contaminated either by nuclear, biological or chemical agents.

Discover The World of Science. "Dogs' Olfactory Ability." Public Broadcasting System. 21 March 1990. The television segment describes the training facility and methods of the U. S. Customs Service (USC) at Front Royal, Virginia. The tape states that over 1,000 detector dogs are employed by USC, that most of the dogs are retriever-like and that the training lasts approximately 14 weeks. The tape makes the comment that the dog has good eyesight, but lacks depth of perception, and thus is very dependent on his nose. The dogs stay at the kennel when they are not working because the training philosophy is based on the play drive (Devaney). Therefore, if the dog stayed with the handler all of the time the play drive would become less effective because the dogs associate the presence of the handler with playing. The tape emphasizes the importance of agility on the part of the dog because it is required to work among suitcases on a moving conveyor belt.

The tape concludes by interviewing Dr. Barb Summerfield at Leeds University in England who is trying to develop a machine to distinguish people by their body odors. She trains dogs to do the same thing in order to calibrate and verify the readings of the machine. Thus far Dr.

Summerfield has discovered that there can be up to 200 different peaks using gas chromatography, but that only 1 part of the graph contains the unique "smell signature." Once this is isolated, Dr. Summerfield claims that a dog can be trained to pick it up for each individual person, except identical twins (Hepper). She also said that she has a long ways to go before a machine can approach the capability of the dog.

DOD Program Solicitation For Small Business Innovation Research. The intent of this document is to motivate and strengthen the role of small businesses in the participation of technological innovation, and increasing commercial application of DOD-supported research. This document describes how small businesses can apply for available DOD funds, lists the methods of selection and evaluation, contractual considerations, submission of proposals, and scientific and technical information assistance.

Dorly, Jeffrey. Letter to CPT Denzil F. Frost, 16 March 1990. This letter contained a list of articles contained in the AKC Gazette that relate to working dogs. The cost of duplication is \$.25 per page. The following is a list of those articles by author:^Ω

Ainsworth, Ivy. Then and Now: Rescuing the Saint Bernard's Past; this noble breed continues to be hearty. 1989, 106 (July) 54-59.

Arner, Lorenz D. Search and Rescue. 1975, 92 (January) 45-49.

Barker, F.B. The Dog Is My Saviour. 1941, 58 (August) 15, 112, 113.

Bassing, Jennifer. Lifesaving Teams. 1983, 100 (April) 44-50, 70.

Borden, Ruth. You Need a Dog For Protection. 1932, 49 (April) 21-23, 121, 122.

- Brown, Catherine H. and Stuart M. Brown, Jr. Should You Ask For Trouble? 1951, 68 (April) 22-25, 255, 256.
- Caras, Roger. The Fallacy of the Attack Trained Dog. 1977 (June) 6, 7, 28.
- Cole, Susan. Fine 'Em! 1980, 97 (September) 66-71.
- Day, William L. Big Terriers Are "Crashing the Big Time". 1943, 60 (February) 20-22, 127.
- Fess, Leroy E. Where Crime Pays. 1951, 68 (February) 20-22, 222, 223.
- Finnegan, George. Red Cross to the Rescue. 1944, 61 (August) 10-13, 191, 192.
- Gettiner, A. Adam. On Guard With a Silver Bullet. 1977, 94 (July) 49-52.
- Hartop, Judy. Air Scenting Makes Sense. 1986, 103 (August) 80-83.
- Heim, Prof. A. How the Saint Dogs Do Their Work of Rescue. 1935, (January) 23-26, 79, 187.
- Jones, Arthur Frederick. Herculean Savior of the Saints. 1926, 43 (September) 17-21, 107, 108, 110.
- Kelsey, Judith Tabler. DOGS East: A Search and Rescue Organization. 1987, 104 (August) 56-59.
- Lagree, Enid S. Saving Lives in Mexico City. 1986, 103 (February) 80-82.
- Marsh, Henry F. St. Patrick's Gift. 1942, 59 (March) 31, 49.
- McDonough, Lori A. The Lady Who Protects the Lady. 1892, 99 (July) 28-32.
- Moustakis, J.L. The Alaskan Malamute In Search and Rescue. 1977, 94 (November) 42-46.

Robb, Judy and Myron. The Ace of Bloodhounds. 1985, 102 (November) 84, 85.

Sherretta, Robert. The Guard Dog That Runs Away? 1980, 97 (February) 41-44.

Spalding, Jane Cochrane. The Making of a Search and Rescue Dog. 1981, 98 (March) 30-35.

Tuttle, Ken. Even Tiny Toys Prove Good Watch Dogs. 1953, 70 (October) 13, 24.

Varham, E.R. Belgium's "Dog Saints": Saints Hubert and Roch. 1945, 62 (May) 12-14, 133, 134.

Doty, Richard L. and David A. Marshall. "Investigation of Mechanisms Underlying Odor Detection." DTIC Number AD-A 140969. The successive daily injection (i.p.) of a specific odorant did not statistically enhance the odor detection capability of rats. This data contradicts the sensitization theory of other investigators cited in the report.

Downey, Fairfax. Dogs for the Defense. New York: McDonald, 1955. This book describes the establishment of Dogs for Defense in January 1942 and the patriotic purposes these dogs fulfilled during World War II.

Drea, Edward J. Letter to CPT Denzil F. Frost, 16 October 1989. This letter contained photocopies of articles found at the Center of Military History. The following list depicts the articles enclosed:

- 1) The Quartermaster Corps: Organization, Supply and Service, Volume II, Erne Risch and Chester L. Kieffer: 323-337 (Washington, D.C.: Office of the Chief of Military History, 1955).
- 2) United States Army Veterinary Service in World War II, John Boyd Coates: 615-642 (Washington, D.C.: Office of the Surgeon General, 1961).

- 3) Field Manual 20-20, May 1967.
- 4) Two Military Review articles.
- 5) One Animal Magazine article
- 6) Animals in War, Jilly Cooper: 54-71.
- 7) Two articles on the Soviet use of military dogs

Dreesen, Thomas D. and Robert B. Koch. "Odorous Chemical Perturbation of ($\text{Na}^+ + \text{K}^+$)-dependent ATPase Activities." Journal of Biochemistry 203(1982): 69-75. This article provides data relating to the biochemical role of phospholipids in determining the activity response to odorous chemicals. The basis of canine olfaction has not yet been fully established. The article further delineates the various accepted approaches that pertain to a complete understanding of canine olfaction, those being psychological, electrophysiological and biochemical.

Drexler, Rudy, Letter to CPT Denzil F. Frost, 1 December 1989. This letter contained descriptions of training, breeds available and price schedules. Training for the specific tasks was described: obedience, image, personal protection, business guard, police K-9, narcotics detection and explosives detection. Breeds available include (AKC Registered): German Shepherd, Doberman Pinschers, Rottweilers and Giant Schnauzers. The letter also mentioned that German imports were also available. The price schedule (3 August 1989) listed prices ranging from \$5,500.00 for a German Shepherd male dog trained in obedience, handler protection, tracking and building search to \$12,000.00 for the same dog qualified for the following additional task: explosive detection. Labrador or Golden Retriever, male or female, dogs capable of detecting narcotics or explosives only, were listed at \$4,200.00, \$8,000.00, respectively

(Taylor, E.). A guarantee for soundness and workability is included with each purchase. Recertification, as defined as retraining and recertification is recommended annually, and is mandatory for supportive court testimony. Prices for annual recertification ranges from \$250.00 to \$550.00 (Andersen, Bushnell, Davis, Sexton).Ω

Dunlap, Harris. Letter to CPT Denzil F. Frost, 1 January 1990. This letter contained a description of Mr. Dunlap's operation. He has been sponsored by ALPO Petfoods for about the last 20 years. His main emphasis is on training sled dogs, sled dog racing, canine nutrition and exercise research. He expressed an enthusiastic willingness to share his expertise in breeding line development, kennel management, nutrition, training, conditioning of the working dog, and sled dog racing if requested. He also uses a computer oriented breeding program and enclosed an outline of his breeding selection index. He also enclosed a sled dog command list to illustrate the types of disciplines his dogs are exposed to. In addition to his genetic data bank, he also has a data bank on training. Also included was a resume which cited numerous publications in refereed journals, to include Veterinary Medicine/Small animal Clinician Pet Practice, The American Journal of Clinical Nutrition and the Journal of Reproduction and Fertility. A booklet, included with the letter and published by ALPO Pet Center, depicts Dunlap's contributions to canine nutrition studies and the development of an ideal diet for the working dog at his kennel (Zero Kennel).Ω

Dunlap, Harris. Telephone interview, 22 December 1989. Mr. Harris described his sled dog training operation, that not only involves training, but computerized breeding and nutrition research designed to develop a

marathon diet for working dogs. ALPO Petfoods has sponsored the research since the early 70's. Mr. Dunlap referred to his training protocol as "play training." He begins training in mass with approximately 60 dogs at a time. He has a closed colony and has developed his own selection index. During the last 20 years he has developed 3 strains of sled dogs that he distributes throughout Norway and Sweden. He said he could tap into this gene pool anytime he wanted via frozen semen. He culls 80 per cent of what he produces, and says the remaining 20 per cent are all super athletes. His training philosophy is, one can train anything, it all depends on tenacity. He uses combinations of 24 vocal commands with different intonations, and hand movements to train and direct his dogs. But he says he is not afraid to use phrases either. He said he would send the author samples of his breeding index, a pamphlet describing his nutrition research, and copies of a magazine, for which he is the editor, called HOWL.^Q

Durrant, Geoffrey R., Brigadier. "Military Working Dog Training Programme of the British Army." 1990 Short Course on Military Veterinary Medicine, Washington, D. C., 2-6 April 1990. Brigadier Durrant begins his presentation by stating that the MWD Programme in the British Army is the responsibility of the Royal Army Veterinary Corps (RAVC) (Burwell). He states that the British do not have a MWD breeding program because of the large number of dogs in the British Isles, and only male dogs between the ages of 1 and 3 years are procured as MWDs. As a result, he concludes that it would not be economical to set up a breeding program since one-half of the progeny would be female (Jepson). British MWDs are bought or accepted as public gifts. The main selection criteria are

boldness, stamina, intelligence and good physical conformation. The breeds used are mainly the German Shepherd and the Labrador Retriever. Brigadier Durrant states that the Labrador Retriever may show less diversity when compared to the German Shepherd. The remainder of the presentation centered on the deployment of the RAVC worldwide and its organizational structure. He concludes that in spite of the tremendous amount of research being conducted on olfaction and alternative models, it is clear to him that the dog "will remain a versatile, efficient, cost effective military tool for a considerable time to come...." He states that the RAVC has accumulated a considerable amount of experience and expertise and is more than willing to share that knowledge with their allied veterinary colleagues.

D'Ver, Abbott S. Letter to CPT Denzil F. Frost, 2 March 1990. Dr. D'Ver discusses the disadvantages of a breeding program and states that a breeding program for a single source use can be, and usually is, very expensive. He attributes most of the expense to the ebb and flow of demand, which he states is usually not synchronized with supply. He also mentions the high number of dogs that do not match "specs" and the problems they present concerning disposal. He says the history of the government is that when you finally have achieved your production goals, the funding is cut (Linn, Nixon, Nolen, Sundgren). As a result, he thinks the government would be better off procuring dogs, because his experience is that the dogs they procure at White Eagle Laboratories, Inc. cost about 1/2 as much as those they breed and raise. Their puppy socialization program begins at 3 weeks of age. He also mentioned that they have the capability to breed large numbers of dogs should the

military become interested. Enclosed also was a brochure describing the organization, its resources, and capabilities.Ω

Eden, Robert S. Dog Training For Law Enforcement. Calgary: Detselig Enterprises, Ltd., 1985. This book provides a general basis for obtaining an overall perspective of what is required to produce a working police dog. Eden emphasizes that control, patience, repetition of tasks, and respect for the dog as an individual (Kay) as all being critical factors leading to successful training and performance of a working dog.Ω

Eden, Robert S. Letter to CPT Denzil F. Frost, 6 December 1989. Mr. Eden describes in his letter the services offered by the K9 Academy for Law Enforcement, which include consultations, custom training and screening of dogs for placement in law enforcement. He also mentions that everything he has seen and heard leads him to believe that the MWD Program needs to be overhauled. He states that the main problem is the need for more modern and versatile training methods. He references his book, Dog Training For Law Enforcement, as a book that has been well received within the industry, but is now out of date. The book was published in 1985. He uses this as an example to illustrate how fast training techniques and philosophy are changing. He feels the training program of the MWD Program is unwilling to change, or adapt, and thus is stagnated. He also referenced the computer network Compuserve as a network that has invaluable resources available at minimal cost.Ω

Fact Sheet "Military Working Dogs." United States Air Force Fact Sheet 87-10. This Fact Sheet gives a general (but the only one available) description of the MWD Program. One unique piece of information found in the Fact Sheet relates to the reported useful life of a MWD to be 10 to

13 years (International Detector). This period is extended out because dogs that cannot meet the standards of full duty are returned to the dog center to be used in training and demonstrations.

Fält, Lars and Erik Wilsson. "The Effect of Maternal Deprivation Between 6 and 10 Weeks of Age Upon the Behaviour of Alsatian Puppies." Applied Animal Ethology 5(1979): 299. Abstract. As a result of this study, the investigators developed a puppy testing program and a classification scheme to identify "good" and "bad" mothers. The study also observed that maternal influence was most effective, or dominant, from 6 to 10 weeks of age.Ω

Fält, Lars. Letter to CPT Denzil F. Frost, 27 January 1990. Dr Fält states that he is no longer with the dog training center at Sollefteå, but now is a free lance ethologist. As an ethologist, he has spent the last 10 years developing testing programs and training methods for working dogs. He is also involved with the Swedish MWD Program. The average age of their dogs is 15 months. He also states that it is possible to use a dog for more than one specialty. He notes that a dual purpose dog is not as good as a single-purpose dog trained for a specific task (Dennis, Kay, McEathron, Mueller, Noll, Walbert). He stresses that training methods have a tremendous influence on how effective a working dog is. He also states that a good breeding program can be very influential on how good a MWD training program is.Ω

Federal Library and Information Center Committee. "OCLC's EPIC Service To Be Available in January." FEDLINK Technical Notes 8 (January 1990): 1. The newsletter explains the EPIC is a new service offered by On Line Computer Library Center (OCLC) Inc. This is a major reference retrieval

system used by most major libraries in the U.S. At this writing, a subject search cannot be done. However, EPIC will allow such searches to be conducted. The newsletter states that the EPIC system will allow access to over 20 million records. The author did not have access to this system, but it is surmised that it could provide valuable leads to additional sources of pertinent information.

Fenton, Jeff. Letter to CPT Denzil F. Frost, 28 February 1990. Sergeant

Fenton begins his letter describing his philosophy about the procurement of working dogs. He prefers an age range of 1-3 years, and states that he is looking for the "alpha" male of the litter. There is only one per litter and he believes that dog is the only one worth training as a working dog. For this reason, he does not think breeding is an effective way to obtain good working dog stock. He also does not believe in training young dogs (less than 1 year old) because he thinks that if you show a dog he can be dominated by a human, as in training, he will grow up thinking all humans can dominate him (Ohrn, "When It Comes...").

With respect to selection criteria, Sergeant Fenton conducts his tests at night, at a strange location to the dog. He says he is not interested in how well a dog will defend his home. He looks for how inquisitive the dog is, will it defend itself, is it balanced (not over aggressive or a fear biter), its reaction to gunfire, and whether the dog can be brought out to be aggressive when challenged and allowed to win. He also evaluates body language, such as the position of the tail in relation to the plane of his back, the position of the ears, and the movement and expressions of the lips. He states that the most important job of a trainer is the

selection of a proper dog and matching that dog with a handler of like personality.

He feels that a lot of a working dog's ability is derived from his handler, and the bond between the dog and its handler is the key to success. He emphasizes that the dog-handler team concept is a "story that needs to be written together."

Sergeant Fenton mentioned that he has gone through the training school at Lackland and makes the following observations: 1) He questions the MWD handlers devotion to the dog and their mission. He got the impression that to most of the handlers, it was "just a job." 2) The training methods used at the DODDC are outdated, with regards to patrol, bombs and narcotics. He states this from the reference that real life experiences for the teams are non-existent or are very limiting. 3) Dog training is an evolving discipline and when you train in the same area (building, field, or plane) the dog's performance just becomes an extension of obedience. He states that the dog knows the difference between training and the real situation. He needs to be stimulated with different locations, decoys, and times of the day for each search. 4) "Mass production does not serve any purpose." 5) He feels the major reason for failure in the MWD Program is the "lack of transition from the training to the real life situations." He cites as an example where the dog is trained to bite on the sleeve only, at a certain location. This programs the dog to key in only on the sleeve of a fleeing suspect, who may not present a sleeve to bite, nor be in the familiar position in a real situation. He says the solution to this problem is to get an effective bite suit, and use different decoys at different locations so the dog cannot

tell whether he is in training or in a real life situation. He also emphasizes that the training must be kept up on a weekly basis. 6) The narcotic dogs need to train with "street grade" narcotics instead of "pure dope" because the drugs are "cut" with various agents and these can serve as distractors to the dog.

He ends this section by asking the question, Do you want dogs that are all show, or all go?" Sergeant Fenton only selects German Shepherds, 1-3 years of age for the Phoenix Police Department. He also stated that all police dogs procured for use within the state of Arizona, must first graduate from his training program. He acknowledges that a quality dog can be expensive, but he feels they are well worth it. He usually spends between 1,500.00 and 3,000.00 dollars for a dog (McCathern, Combined Arms Center, Reaver). He says the demand for top quality dogs is reflected in the price because the Schutzhund sport people have the money and are willing to spend it to get the same type of dog needed for police work. He looks at approximately 50 dogs in order to find the right one (Caldwell).Ω

Fenton, Jeff. Telephone interview, 5 March 1990. This interview centered around a book entitled Scent and the Scenting Dog (Syrotuck). According to Fenton, this is the Bible of working dogs used for tracking human beings, especially fugitives. Sergeant Fenton feels that there is a lot of pertinent information in this book the needs to be included in the MWD handler courses. Information that will save the lives of these handlers as they track fleeing suspects. Fenton gives numerous testimonials of how the information in this book has saved his life many times.Ω

Fischer, Karen. "The Dogs of War." Montana Magazine. (November-December 1989): 51-57. This article describes the unsung role of the Arctic Search and Rescue units mainly in Alaska, but also their unique, intended mission during the Battle of the Bulge.

Fox, Frank Jr. Letter to CPT Denzil F. Frost, 9 January 1990. Mr. Fox referred the author to Mr. Harris Dunlap as ALPO Food's spokesman for socialization, training and breeding operations as they pertain to research conducted by ALPO. Q

Francis, Cle. "The Dog as an Anti-Terrorist Tool." Dog World (April 1989): 12, 45. This article contrasts the sensing capabilities and limitations of the dog to those of synthetic sensing devices, and the challenges of being able to detect new explosives and related challenges associated with anti-terrorist activities.

Francis, Cle. "Bomb Dogs in the Semtex Age." Dog World (May 1989): 28, 63. This is a follow-on article to Francis' April 89 article.

Francis, Cle. "Science Backs the Canine Sniffer." Dog World (June 1989): 12, 34-37, 40. This article relates the impact of research conducted at the South West Research Institute (SRI) in San Antonio, Texas by Edward Dean, D.V.M. and Sam Tomlinson, research scientist and trainer, on the effective use of dogs in explosive and narcotic detection today. The programs at SRI are reviewed in some detail. In addition, success stories of some of their canine pupils are discussed.

Freedman, David G., John H. King and Orville Elliot. "Critical Period in the Social Development of Dogs." Science 133(1961): 1016-1017. This article supports the work of Scott and Fuller, and Pfaffenberger in that they identify the 7th week after birth as the most crucial to the

receptivity of the dog to socialization. The authors also identify the critical range for socialization to be between 2 1/2 to 9-13 weeks of age.

Frost, David C. Letter to CPT Denzil F. Frost, 31 January 1990. This letter is a narrative of Mr. Frost's experience as a trainer/handler at the DODDC from September 1968 to 1981. The letter contains numerous documents that provide perspective to the environment at the DODDC during Frost's 23 years, as reflected by management, missions and philosophies of training and procurement. From this background, the intent here is to focus on Frost's comments with respect to the development of current problems and how he thinks they could be resolved. From the letter, the following factors, in Frost's opinion, played a major role in the problems now seen at the DODDC:

- 1) Dog Training Section (DTS) - The main drive behind the formation of DTS was budget constraints. DTS was developed to relieve the requisition backlog problem in 1985. Frost says that the trainers objected because it would dilute the experience pool by training handlers on trained dogs. He concludes that goals were never met. As a result, the requisition backlog went from 70 drug dogs to over 500 (McCathern). Frost attributes the end result primarily to handler inexperience (Reaver). He further states that management is now considering using same program for Explosive Dog training.
- 2) Dogs are not selected by trainers. He says that in every other training program he knows of the trainers select the dogs.
- 3) DODDC is not cognizant of new training developments outside the gate.

- 4) Retrieve drive is an attitude and thus should be evaluated at least 3 hours after a dog has eaten.
- 5) A detector evaluation test needs to be developed because right now, the dog brokers are training the dogs to meet the current selection criteria.
- 6) Lack of handler experience. He claims that if a random sample of MWD handlers were selected for recertification, without notice, 40 per cent of them would fail.
- 7) The MWD Program is no longer the standard bearer of the industry. In some circles he feels that the DODDC is no longer even credible.
- 8) Homesteading. There needs to be a greater rotation of personnel
- 9) Loss of dedication to training standards among personnel (Fenton).
- 10) Recycling of dogs. Frost feels too much time is wasted trying to get dogs to pass once they have failed a particular course (Andersen, Parks).
- 11) Failure of AFOSP to project the needs of the Using Agencies.
- 12) Training Protocol. Frost states that this is the one document that has caused more problems than any other. He says the rationale for this protocol is that if an instructor follows the instructions, anyone can train a dog. He claims that no acknowledgment for the dimension of art is considered.
- 13) Invalid statistics. Frost feels that the statistics compiled at DODDC are biased. He states that he had requested numerous times to conduct pilot studies to evaluate the effectiveness of various procurement and training methods but that he was turned down each time.

- 14) Before training starts one must know the limitations of the dog.
 - 15) Many of the new programs/philosophies were probably driven by budget constraints.
 - 16) Handlers and trainers used to have 10-20 weeks to observe a dog, now they're lucky if they get 5 minutes. In addition, he claims that many times the evaluation is done by someone with insufficient experience.Ω
- Fuller, William J. "Discussion of Some Service-Dog Temperament Components." The paper was included with a letter from Dr. Fuller. The publication date and source of publication was not given. Dr. Fuller begins this paper by providing a glossary of terms (sense, stimulus, threshold, aggressiveness, bravery, shyness, courage, cowardice, sycophancy, viciousness, sovereignty, guard-dog, personal-protection-dog, police-dog, and watch-dog), from which he then discusses the identification of the specified temperament characteristics associated with the type of dog intended. He states that by using his glossary, it is then possible to objectively set criteria of what to expect in evaluating a particular dog. He also references the work of Drs. Menzel and Bodingbauer who have studied canine temperament characteristics extensively (Bodingbauer). Dr. Fuller then references a "soft" and "hard" Henze Test to evaluate the true temperament characteristics of juvenile dogs. The types of temperament are: Sharp, Brave; Sharp, Shy; Non-sharp, Brave; and Non-sharp, Shy. Dr. Fuller then devotes considerable space to the distinctions between these 4 archetypes in order to provide a more orderly examination of temperament evaluation. He concludes by stating, "It is important that serious breeders divert themselves of the

subjective and promotional nonsense regarding temperament in such publications as the A.K.C.-recognized "Official Breed Standards" of many of the working dog breeds so that they may join in the study of, and contribution to, the vitally important work being done by objective investigators in the field of dog behavior."Ω

Fuller, William J. Cassette tape addressed to CPT Denzil F. Frost. This tape was sent by Dr. Fuller upon request by the author to questions relating to selection characteristics, temperament evaluation and breeding programs for dogs. Dr. Fuller begins by referencing an U.S. Army Manual that was compiled by Elliott Humphrey during World War II. Most of the information came from Humphrey's book (Humphrey). Fuller states that, in his opinion, this is the classic on how to produce an effective working dog (Kay). He also references the work of Bodingbauer, and his own expertise that was gained by working with Bodingbauer, as excellent sources for information on temperament selection for working dogs. Dr. Fuller assumes that any program proposed by the U.S. military would use German Shepherds, and as such, states that 2 options are available: 1) Set up a breeding program, or 2) Import dogs from Europe. He mentions a third option that entails rejection rates between 90-95 per cent if state-side dogs are used. He continues by emphasizing that if option 1) is selected, the breeding program must be long-term and will require a large number of dogs. He states that the government has already taken that route once, and the results were not favorable enough to continue (Biosensor, Gilbert, Lees, Linn, News Release, Whitstock). If the military chooses to procure dogs from Europe, especially West Germany, he lists the following advantages: 1) The German system

requires a working herd degree, either GGH or the Schutzhund degree (Reaver) 2) All dogs must be evaluated by a Breedmaster before they are allowed to breed. 3) In addition, each approved dog must have hip x-rays and a stamp of approval tattooed in the ear. 4) There is also an endurance certification that requires a dog to run 12 miles at 6 miles per hour without collapsing. Therefore, Dr. Fuller feels that the German system offers tremendous advantages, when compared to the American Kennel Club, where all someone has to do is pay a registration fee. He also mentions that it is a criminal act in West Germany to falsify any part of the dog certification process. He attributes the success of the German system to the national policies that result in continuity of effort.

Regarding the biosensor program, he feels that it failed for the same reasons the ancient Greeks failed to make a superman. Dr. Fuller feels that great virtuosos or any other biological creation of marked superiority are "genetic accidents", and that any program that tries to produce this superiority in a consistent manner is doomed to fail. He thinks a more reasonable goal would be to develop a program that would consistently produce good quality working dogs (Mueller).

Concerning the criteria for selection and evaluation, he references Pfaffenberger for puppies, Bodingbauer for juveniles and Humphrey for adults. Dr. Fuller stresses the importance of developing or using the systems mentioned above that will weed out any possible bad temperament characteristics early on because you do not want to find out the true colors of a dog in a dangerous situation. If the procurement route is selected, he feels that the Schutzhund I and II titles would

guarantee acceptable dogs with excellent temperaments (Mackenzie, Canine). He concludes by offering to help in any way he can. He says he has many books that he would supply upon request, and that the military should invite over noted German trainers and experts to conduct seminars and train military personnel on the current state-of-the-art relating to the production of top performing working dogs. He also cautions against using Pfaffenberger's breeding program because of reports of poor temperament in some of these dogs that were donated to the San Francisco Police Department.Ω

Gage, Herbert M. and William A. Wall. "An Investigation of the Sensitivity of Trained Detector Dogs for Vapors of the Explosive Ethylene Glycol Dinitrate." U.S. Army Land Warfare Laboratory, Aberdeen Proving Ground, Maryland. Technical Report No. 74-14. May 1974. This report states an accuracy of 95 per cent for the detection of ethylene glycol dinitrate by dogs. The report recommends that further research be conducted to determine the threshold sensitivity of dogs to explosives and narcotics, to determine the limitation of the total number of combinations of compounds the dogs can effectively detect, and to identify and evaluate the effect of different interferences that may limit the ability of a dog to detect explosives or narcotics.

Gilbert, William D., B G. "Disposition of the Military Working Dog Program." U.S. Air Force, Deputy Director, Engineering and Services, 9 June 1976. This letter was included in the packet of information sent to the author by Dr. Jeffrey Linn. The main reasons expressed in the letter for ending the program were that the program was a "questionable venture," because there were no requirements for genetically superior dogs in the U.S. Air

Force. The letter acknowledged that the program had been a success in producing "enviable pedigree lineages," which could conceivably provide a detection capability, but this was not viewed as a projected requirement for the future. The letter ended by offering to "expeditiously" transport all assets of the program on a nonreimbursable basis to the DOD Dog Center in Lackland to be used by the Army, should that desire be expressed [Author's Note: The U.S. Army could not decide on a proponent agency to handle the transition of the program from research and development to an operational mode. As a result the program came to an abrupt stop with all resources disposed of as quickly as possible. The breeding stock was donated to the U.S. Coast Guard and the Seeing Eye Corporation (Biosensor, Fuller, Leighton, Lees, Linn, News Release, Whitstock).]

Ginsburg, Benson E. Letter to CPT Denzil F. Frost, 4 January 1990. Dr.

Ginsburg relates in his letter that there are plenty of organizations that could assist in setting up a breeding program. He states that the advantages include utilization of their own facilities, and the maintenance of good breeding stock supplemented by programs to test and raise puppies that are socialized and screened. Concerning the MWD program, he was unaware of the military's need for dogs and concludes that a more directed public relations program should be implemented. He states that training should not be the problem, since the methods should be well worked out by now. Reflecting from his own work, he mentions 2 methods he uses to obtain the characteristics needed for specialized working qualities. One is selective breeding and the other is screening dogs available from a variety of sources. He says both work if properly

done. He also makes reference to Pfaffenberger's book, Guide Dogs for the Blind, as a source of answers for any questions that may arise in setting up a dog breeding/training program.Ω

Ginsburg, Benson. Telephone interview, 19 December 1989. Dr. Ginsburg referenced his participation in writing Guide Dogs, Their Selection, Development and Training, and said the puppy tests did not select for temperament. He said he felt the "willingness drive" and olfactory capability should be the traits emphasized, but that there is little research information describing and quantifying canine olfactory capability. When asked about the factors that should be considered for setting up a breeding colony, he strongly recommended staying away from show breeds, and that you should start out with unrelated lines. "That way they won't poop out." He also referred the author to Dr. Ray Coppinger.Ω

Goddard, M. E. Letter to CPT Denzil F. Frost, 23 February 1990. Dr. Goddard states in his letter that he is no longer involved in research with dogs, but emphasizes that he is sure anyone who sincerely wants to obtain a better quality dog will have much more success developing a breeding program that will produce dogs above the breed average. Although he emphasizes that whether or not it is worthwhile depends on the cost. He writes that "rearing dogs is a major problem." He states that for guide dog work, and he suspects for other types of dog work, rearing the dogs in a kennel is unsatisfactory. He recommends that the dogs be placed in a home from 12 weeks of age until they are 12 months old, because the puppies need this time to become accustomed to a wide range of stimuli, and to form a relationship with humans.

Also included in the letter was a paper written by Dr. Goddard, entitled, A Breeding Program For Guide-Dogs. Dr. Goddard said he included it as a good summary of the research he had conducted for the Australian Guide Dog Association. In the paper, Dr. Goddard states that an animal's appearance and behavior depends on both the genes it inherits from its parents and on the environment in which it grows up. He recommends the following steps to be taken when setting up a breeding program: 1) Decide on the aim of the breeding program. 2) Identify the traits that must be improved. 3) Find out as much about the genetics of these traits, i.e. are there differences between breeds, does hybrid vigor occur, how heritable are they? 4) On the basis of this information decide which is the best method to improve each of these traits. 5) Formulate a practical breeding program using these methods of genetic improvement.

Concerning correlations between measures of fearfulness, Goddard states that nervousness, suspicion, sound shy, nervous aggression and anxiety are all correlated with one another, and that this indicates that a dog expressing any one of these traits will also tend to score high in the others. He found no correlation between fearfulness and excitability. He also mentions that by simply reducing fearfulness you also can expect to see a decrease in distraction and aggressiveness, and an improvement of performance in several types of training.

With respect to the suitability of specific breeds of dogs, (German Shepherd, Kelpie, Boxer, Labrador) he mentions the German Shepherd as the most fearful and the Kelpie as the least fearful. He found no hybrid vigor i.e. cross breeds were no better or worse than the purebreds.

Concerning the effect of age, sex and experience on training, Goddard concludes that the young dog is less able to learn inhibitory training tasks than older dogs. Also that changes in distraction and excitability may not have the same meaning in a mature dog as they do in a younger dog. Females tend to be more fearful than males, especially of strange objects. They also are more distracted by smells and more excitable, and the trainers also rated them as more sensitive. Although, overall he found that their success rates (completing guide-dog training) were almost equal. Puppy socialization is rated by Goddard as being crucial to providing the experience spectrum associated with growing up with a human family. He notes that dogs with little experience tend to be over alert and more afraid of objects they might meet while walking down a street or sidewalk. He also noted that dogs which are not placed in homes until they are 16 weeks or older have a very low success rate in the guide-dog training program. Concerning methods of early prediction of suitability as a guide-dog, Goddard recommends a series of tests beginning at 4 weeks of age. He corroborates the work of Scott and Bielfelt in that puppy tests based on emotional responses, leash training and retrieving all show accuracy in predicting success in guide-dog training. He also emphasizes that regardless of age, the most reliable test for prediction is the most recent one. However, for overall predictability, especially against fearfulness, selection is best carried out by taking into account all of the observations, and placing a little more weight on the most recent observations.

Relating to specific breeding programs, he states that improvement of any strain requires replacement of stock from the best sons and

daughters, and to maintain a large enough number of studs and bitches to avoid the complications associated with inbreeding. Pertaining to the selection of breeding stock, he states that no dog that is unsuitable as to the primary working dog requirements should ever be used for breeding. Emphasis should be placed on selection of those traits that are the most important in the end product, and are the most heritable. As such, Goddard recommends that selection should be first against fearfulness, then against hip dysplasia, aggression and dog distraction, and then excitability. (Author's Note: These recommendations are for the selection of guide dogs, but in many ways are applicable to all working dogs). In structuring the breeding system, he assumes that each bitch produces on the average 1 litter of 6 live pups every 9 months. If 48 guide dogs are required per year, approximately 96 pups must be produced or 16 litters must be born each year i.e. 12 bitches must have a litter each 9 months (Rankin). The fewer the number of dogs that are kept for breeding stock the greater the intensity for selection, but also the rate of inbreeding is also increased. Goddard states that rapid progress may be attained by replacing studs and brood bitches from the next generation. He calculates that keeping bitches for 2 litters and studs for 4 litters results in the fastest rate of improvement. The downside to this is that a high percentage of dogs are used for breeding and hence are not available as candidates for training. He provides a more practical regimen by keeping brood bitches for 4 litters and stud dogs for 8 litters, or keep the bitches for only 1 litter and then spay them and train them.

The last part of the paper addresses the trainer's scoring system.

Goddard believes that a scoring system is essential in order to compare dogs. The 2 options are to describe exactly how each dog behaves under every circumstance, but this would be very long and cumbersome. If you place a group of observations together into a score, the evaluation may be simplified but no doubt some valuable information will be lost.

Goddard's solution is to group together observations that are highly and consistently correlated. This in turn will minimize the amount of information that may be lost. Goddard then argues that the second requisite of an efficient scoring system is that the scores be sufficiently clear that independent scorers will have a high probability of agreeing on their evaluation of the same dog. Goddard developed a system that does this by measuring the repeatability among trainers, and thereby once you know which trainers consistently score high, you can adjust their scores confidently. The repeatability of trainers scores between trainers for the following traits are: nervousness (0.70), suspicion (0.62), concentration (0.65), willingness (0.0), distraction (0.45), dog distraction (0.69), nose distraction (0.39), sound shy (0.50), hearing sensitivity (0.31), body sensitivity (0.37), aggression (0.12), nervous aggression (0.26), excitability (0.47), and anxiety (0.67).Ω

Goddard, M. E. and R. G. Beilharz. "A Factor Analysis of Fearfulness in Potential Guide Dogs." Applied Animal Behaviour Science, 12(1984): 253-265. This study attempts to predict from factor analysis the degree of fearfulness, as reflected by approach, avoidance, nature of contact with stimuli, tail position and posture to numerous stimuli. The investigators concluded that the avoidance responses showed the highest

correlation to fearfulness, and that accuracy of predicting fearfulness increased with the age of the subject.Ω

Goddard, M. E. and R. G. Beilharz. "A Multivariate Analysis of the Genetics of Fearfulness in Potential Guide dogs." Behavior Genetics. 15(1985): 69-89. The investigators utilized a diallel cross using 4 breeds of dogs to record 38 measures of fearfulness. The breeds examined were the Labrador, German Shepherd, Boxer and Kelpie. Three functions were considered. They were measurements of general fearfulness, genetic variation and environmental variation. The study concluded that Labradors were the least fearful, and the German Shepherd the most fearful. Heterosis for general fearfulness was not observed, but significant within-breed variation was noted. The study concluded that fearfulness can be reduced through selection. Optimal methods of selection against general fearfulness are discussed.Ω

Goddard, M. E. and R. G. Beilharz. "Early Prediction of Adult Behaviour in Potential Guide Dogs." Applied Animal Behaviour Science. 15(1986): 247-260. This paper examines the results of a battery of behavioral tests conducted on puppies between the ages of 4 weeks and 6 months. The effectiveness of the tests to assess fearfulness, activity and learning ability were evaluated. The ability to predict adult fearfulness increased with age. The authors noted the existence of genetic variation concerning fearfulness between dogs when young, but concluded that selection against this trait would be more effective if carried out when the dogs become adults. The authors concluded that the tests were ineffective in predicting specific learning capability.Ω

Goddard, M.E. and T. A. Mason. "Genetics and Early Prediction of Hip Dysplasia." Australian Veterinary Journal, 59 (1982): 1-4. This paper examined 4 breeds of dogs (Labrador, Kelpie, Boxer and German Shepherd) to determine their propensity for hip dysplasia by using joint laxity evaluation at 8 weeks of age and hip radiography at 15 months of age. The purpose of this paper was to provide information on breed differences and heterosis in hip dysplasia. The authors conclude that in addition to there being variation between breeds with respect to hip dysplasia, there is also variation within a breed for the same condition, and that hip joint laxity in neonates is correlated to radiographic hip dysplasia in adults. As a result, the authors conclude that hip palpation scores can be helpful as a prediction of future hip dysplasia status, when selecting between litters (0.70), but not within a litter (0.17).Q

Goddard, M.E. and R.G. Beilharz. "Genetics of Traits Which Determine the Suitability of Dogs as Guide-Dogs for the Blind." Applied Animal Ethology, 9 (1983): 299-315. This paper is designed to present information on the success of breeding and rearing programs, and the genetics of the traits selected to provide optimum suitability as guide dogs. Five factors are recommended by the authors for consideration during selection for guide dogs. The factors are, distraction, general performance, sensitivity, fearfulness, and fearfulness accompanied by high activity. The authors reported an absence of negative correlation between desirable traits and concluded that it was possible to obtain overall improvement. The authors further concluded that due to the poor performance of donated adults versus donated puppies who underwent their "puppy-walking scheme" (foster homes) demonstrated the value of

the foster home concept and monitored socialization. The authors further state that the scores cannot predict a dog's final performance on a specific task, but there is reliable capability to predict reliability between these traits and the performance of fully trained dogs.Ω

Goddard, M. E. and R. G. Beilharz. "Individual Variation in Agonistic Behaviour in Dogs." Animal Behaviour 33(1985): 1338-1342. Based on behavior recorded from 102 dogs from 4 breeds and 6 crosses, the study concluded the agonistic behavior in dogs is highly influenced by maturity and the temperament of the dog confronted, either by man or by another dog.Ω

Goddard, M. E. and R. G. Beilharz. "The Relationship of Fearfulness to, and the Effects of, Sex, Age and Experience on Exploration and Activity in Dogs." Applied Animal Behaviour Science. 12(1984): 267-278. This paper states that dogs may respond to the stimulus of fear by increasing or decreasing activity. Olfactory exploration did not seem to be inhibited by fear. Dogs which were raised with at least one other dog seemed to be less susceptible to distractions. Female dogs expressed higher levels of activity and olfactory exploration during inhibitory training than did males in the same situations. Correlations between measurements of activity under different circumstances were reported to be positive, but low.Ω

Grünrowsky, Manfred. Letter to CPT Denzil F. Frost, 12 January 1990. The letter is written in German, as are all of the enclosures. Jutta Barr and Giesela Counts translated the letter and described the general content of the German news articles taken from various magazines. Mr. Grünrowsky states that there the German State Police use approximately 470 dogs, of which 70 are trained as drug or explosive detectors. He mentioned

that the following breeds are used: German Shepherd, Rottweiler, Giant Schnauzer, Doberman, Airedale Terrier, and the Boxer. All dogs are purchased from private citizens. The dogs then undergo 4-6 weeks of evaluation and training to assess their ability to learn and obey. If they pass all of the tests the German government then purchases the dog and it becomes police property. At that time the dog is assigned to a student handler and they both attend the German Police Academy for 3 months of training. At that time if the dog indicates additional ability to become a detector dog, both he and the handler undergo an additional 50 days of training in either drug or explosive detection. The handler is then assigned to a specific section of the country, and he and the dog go directly to their new assignment. The dog lives in the handler's home. Mr. Grünrowsky mentions that during the past year the German Police Academy began raising their own dogs, and that several colleges are doing the breeding and whelping.Ω

Grünrowsky, Manfred. "Police Duty Dogs in North-Rhein/Westfalen; West Germany." Trans. Sgt. Carl F. Meding. K-9 Enforcer 4 (4th ed. 1989):9, 10. This article describes the normal activities of a working dog team in West Germany and the types of tasks performed. A small description about training is also included.Ω

Guide Dogs For the Blind. Letter to CPT Denzil F. Frost, 16 October 1989. This letter contained fact sheets on the history of the organization, the Golden Retriever, the German Shepherd, guide dog training, guide dog harness, guide dog instructors, raising a guide dog, career change dogs, how guide dogs get their names, a love story: guide dog style, and the Labrador Retriever. The organization was established in 1942 to aid

blinded war veterans. To date they have provided dogs for over 6,000 blind people. This is a tax exempt charity that has an annual budget of 6 million dollars. The school has a staff of 93. Operation is solely from private donations; there are no professional fund-raisers. As a result, 92 per cent of all contributions are devoted to producing the blind person/dog team. It costs, on the average 12,000 dollars to produce and train one guide dog, that is then given to the blind person. Only 50 per cent of the dogs that commence training will complete the training at the end of 5 months. The guide dog breeds are limited to German Shepherds, Labrador Retrievers (both black and yellow) and Golden Retrievers. The majority of the dogs are bred at the Guide Dogs' facility, which occupies 11 acres. The puppies (of which there are usually about 150 on the campus at any one time) are born at the school and stay with their mothers until they are 6 weeks old. They remain at the school until they are 3 months old. During this time they undergo socialization as described by Scott and Pfaffenberger.

At 3 months of age the pups are given out to puppy raisers, usually 4-H members (there are approximately 650 dogs being raised at any one time). The dogs remain with the 4-H members in their homes for about 15 months. The distribution range of the pups extends throughout the western U. S. and Alaska. During this time the dog will learn basic commands, house training and social skills from the raiser. Periodic checks are made by personnel from the facility during this time. In addition, each 4-H recipient receives a pamphlet titled, How to Raise a Guide Dog Puppy. When the dog is about 18 months of age it is returned to the school to begin formal training.

The training is conducted by the school's California state-licensed instructors who work with a string of 28 to 30 dogs. In order to become licensed, an instructor must complete a 3-year apprenticeship. This apprenticeship includes experiencing a class from the perspective of a student. They are assigned a dog and for 10 days live under a blind fold with a blind student. It take 5 months of training before a dog is ready to be matched with a blind person. This entails a minimum of 40 workouts before the dog is ready to enter class with a blind person. Those that do not complete the training are identified as "career change" dogs and are adopted out to a lucky person on a lengthy waiting list. After working with the dogs for 5 months it can be difficult to release a dog to a new person. But the bond formed between the instructor and a dog allows the instructor to see what characteristics a dog has that make it suitable for a certain person. While the instructors have 5 months to learn a dog's disposition, they only have 3 days to observe a student's. The students have 28 days to assimilate an enormous amount of information and techniques. Instructors visit each student at least once a year. Normally a dog has a working life of about 8 years. The author made a personal visit to this facility in October of 1989.Q

Hammond, Shirley M. Letter to CPT Denzil F. Frost, 19 March 1990. Ms.

Hammond describes in her letter the California Rescue Dog Association (CARDA). There are 34 mission ready teams, of which 7 are trailing dogs. Many different breeds of dogs are represented in the association, and each handler owns and trains his/her own dog. She mentions that many handlers select their dogs using the AKC Puppy Aptitude Test (Author's Note: The specifics of the Puppy Aptitude Test can be found in the AKC

Gazette, May 1987: 67, 68). She also mentions that a good search dog should be self confident, curious, willing to leave the pack to investigate, have a degree of independence, have a good prey drive, have a good recovery from a startle response, be energetic, have correct conformation, and be in good physical condition.Ω

Harfield Alan. Pigeon to Packhorse. Chippenham: Picton Publishing LTD, 1989. This book presents the contributions of animals in facilitating communication within the British Army. The book contains many illustrations of animals in action, and devotes a few pages describing the use of dogs as message carriers (Cooper, Jilly).

Hart, Benjamin L and Michael F. Miller. "Behavioral Profiles of Dogs."

Journal of the American Veterinary Medical Association, 186(1985): 1175-1180. Behavior profiles for 56 breeds of dogs were developed using 13 distinct traits. Development of the profiles came from 48 small animal veterinarians and 48 obedience judges randomly selected from respected directories representing the eastern, central and western regions of the U.S. The data was analyzed using a customized computer program. The conclusion of the study indicated that it was possible to develop a statistically-oriented behavior profile that integrates comparative rankings of the evaluators.

Hart, Benjamin L. and Lynette A. Hart. "Selecting Pet Dogs on the Basis of Cluster Analysis of Breed Behavior Profiles and Gender." Journal of the American Veterinary Medical Association, 186(1985): 1181-1185. The investigators rank 56 breeds based on 13 behavioral traits. The results are categorized into 3 factors: reactivity, aggression and trainability. These 3 factors accounted for 81 per cent of all the variability. The

authors conclude that the gender and cluster profiles can serve as effective tools in matching emotional and physical characteristics of a dog to the purpose intended by the owner.

Hart, Benjamin L. and Lynette A. Hart. Canine and Feline Behavioral Therapy. Philadelphia: Lea & Febiger, 1985. This book is the result of behavioral problems becoming more common in a veterinary practice. The increased frequency is probably due to the combination of an increased education and awareness of the client and the veterinary clinician. This book is designed as a reference handbook which covers practical tips, and contains 18 chapters on specific behavioral conditions. Additional chapters assist in the understanding of the concepts discussed for each cited condition, and the respective therapeutic approach.

Headquarters, Northern Ireland VR Branch. The Tactical Use of Dogs in Northern Ireland. (1976). This pamphlet describes the use of working dogs in order to "provide a brief tactical aide-memoire" (p. 1) about the dog's capabilities, and how to improve the utilization of those capabilities. The pamphlet states that little importance needs to be directed toward the selection of a specific breed, other than the Bloodhound that is recommended specifically for tracking. Many photographs are provided to depict how each type of working dog is used. The pamphlet discusses 4 types of working dog, namely Guard, Security, Arms Explosive Search, and Tracker (Durrant, Jepson).

Hepper, Peter G. "The Discrimination of Human Odor by the Dog." Perception 17(1988): 549-554. Provides data relating to the ability of dogs to discriminate odor from twins differing only genetically (non-identical)

or environmental factors (Discover). Hepper demonstrates that both genetic and environmental factors combine to produce individual characteristic odors, and that the Major Histocompatibility Complex may influence odor uniqueness. He concludes that dogs can discriminate between twins, if they are not identical (monozygotic) or are influenced by different environmental factors such as diet (breast-fed versus bottle-fed), bathing frequency, soap variety or from different homes.

Houpt, Katherine A. "Companion Animal Behavior: A Review of Dog and Cat Behavior in the Field, the Laboratory and the Clinic." The Cornell Veterinarian 75(1985): 248-261. Houpt reviews the 5 critical periods identified by Scott, examines the ecology of urban dogs, and reviews temperament tests reported in the literature that are designed to select for working dogs. A discussion of canine behavior problems is also included.Q

HQDA (SGRD-RP). "Transmittal of Biosensor Program." Staff Study. 2 January 1976. Obtained from Dr. Jeffrey Linn. The study is based on the assumption that the biosensor program had reached its objective, that was geared for research, and that the objective of developing a superior military working dog had been obtained. Thus disposition was appropriate. The study provides a detailed synopsis of the biosensor program, to include success stories. In order for the program to gear up to a production mode, it was estimated that 300 pups would have to be produced, which would yield approximately 225 dogs suitable to training (Goddard, Rankin). The following options were discussed: 1) Disband the in-house dog breeding program and rely on procurement from civilian dog owners to meet DOD dog requirements. 2) Distribute the breeding stock

to civilian dog breeders as a remount service, as done by the Army for horses prior to World War II. 3) Convert the biosensor facility to a OMA-funded operation. 4) Relocate minimum level dog breeding activity to the DOD Dog Training Center. Option 3 was recommended but was deemed to be too expensive. Therefore it was recommended that multiple agency support be solicited. If such support could not be found, the whole operation was to be transferred to Lackland AFB. Enclosed with this Staff Study is a Disposition Form that provides individual assessment of the trainability of some of the biosensor dogs and additional letters of commendation by users for what was accomplished by the program, or its implication for utilization, both within and outside of the military.

Humphrey, Elliott and Lucien Warner. Working Dogs: An Attempt to Produce a Strain of German Shepherds which Combines Working Ability and Beauty of Conformation. Baltimore: Johns Hopkins Press, 1934. This book describes the work of Fortunate Fields Institute in Switzerland to develop a strain of German Shepherd dogs suited to be guide dogs for the blind. A detailed history of working dogs is included, as well as a description of the research conducted to select the breeding lines, behavioral traits, and sensory capabilities such as hearing, olfaction and sight. The book concludes that the dog's world is "predominantly one of odors." The book notes that the dog shows an extraordinary willingness to work for a man he likes. That reward and punishment may be used, but physical motivation is rarely required. Approval and disapproval can be effectively conveyed by word and gesture. Concerning the inheritance of specific traits, Humphrey states that oversensitivity appears to be overdominant, undersensitivity is recessive, and medium sensitivity is

most likely the hybrid of the two. He also concludes that training willingness is also heritable (Fuller, tape; Kay).

Information Packet. DOD Dog Center, Lackland Air Force Base. Received from Marge McCathern, 21 December 1989. For persons wanting to donate or sell a dog to the dog center, this packet contains information concerning the basic qualifications relating to breed, age, weight, height, sex, temperament and medical examination. The price for an untrained or partially trained dog is 550 or 825 dollars, respectively. The packet also has a x-ray release form and instructions to a veterinarian for completing the medical exam. Evaluation for temperament must be performed by either a kennelmaster or trainer at a military installation. The primary categories for temperament evaluation are listed in the packet, and include testing for aggressiveness, testing with the wrap, and testing for sensitivity to gunfire. Behavior characteristics are also examined and compared against the categories of behavior listed in the packet. The categories are dominant behavior, submissive behavior, and play-soliciting behavior.

Information Paper. "Potential for Expanded use of Military Working Dogs." 17 July 1989. DASG-VC. This paper justifies the military working dog's potential and documented performance in past conflicts to be able to fulfill expanded roles in low intensity conflict that would be required to meet operational demands.

International Detector Dogs, LTD. "Explosive and Accelerant Detection Canines." Information and Handler's Manual. This manual begins by reviewing the dog's repertoire of detection capabilities, such as minimal costs to operate, loyalty, speed of detection, and non invasive detection.

The manual states that a well trained canine unit can inspect over 200 pieces of luggage per hour and many hundreds of parcels at twice the speed of visual or electronic searchers. The manual estimates the working life of a working dog to be 9 years (Fact Sheet). In the firm profile, the statement is made that this organization has clients throughout the U.S. and many recognized foreign governmental agencies and industries. The manual lists 3 innovative benefits of the detections dogs trained by this firm. They are: 1) Their dogs work effectively for multiple handlers. 2) They are one of the pioneers in canine accelerant detection. 3) The "scent wheel" used during training makes it very easy to increase or change a dog's range of scents. With respect to selection criteria, the manual stresses health, temperament stability, adaptability to all environments, easy to care for, thorough socialization, and a big appetite. Training at the firm is done using food as the primary motivator and references the principles championed by the Nobel Prize Laureate Ivan Pavlov (classical conditioning), and famed behaviorist B.F. Skinner (operant conditioning). Justification for this philosophy is based on the acceptance of the food drive being second only to the sex drive as a factor of motivation. As such, all dogs are trained to go past all types of enticing foods looking for explosive or narcotic substances, knowing that these substances must be found before they will be fed. The manual states that from experience the German Shepherd and Labrador Retrievers have the most capability for success and detection canines. According to the manual, color nor sex is important. The preferred age range is 1 to 2 years. All dogs are spayed or neutered prior to the commencement of training. The evaluation process should also include

observing the dog's ability to negotiate slick floors, metal stairs, maneuvering in and out of vehicles, and noisy, congested areas. The remainder of the manual describes the various phases of training and equipment used, such as discrimination and imprinting, the scent wheel, vehicle examination, search pattern behavior, basic obedience, playtime, obstacles, hup, balance beam and "easy", ladder, catwalk and gangplank, seesaw, accelerant detection, and the effective use of detection dogs.Ω

International Guiding Eyes, Inc. A press kit contained in a letter from Jane Brackman to CPT Denzil F. Frost, 10 January 1990. International Guiding Eyes, Inc.(IGE) was incorporated as a not-for-profit California corporation on July 28, 1948. The facility occupies a 5.5 acre site that has a training capacity of 200 dogs and students. The average cost of a trained dog is 10,000 dollars. Prior to 1981 mostly German Shepherd were used. At present, only 20 per cent of their dogs are German Shepherds. Other breeds used and the percentages are Labrador Retrievers, 70 per cent; Golden Retrievers, 8 per cent; and other, such as Border or Flat-coated Collies. IGE feels that Labradors and Golden Retrievers have higher success rates as guide dogs.

The press kit also states that there are 500,000 legally blind persons in the U.S., and that of this total, about 50,000 could possibly use a guide dog. Unfortunately only about 1,200 guide dogs are trained throughout the U.S. annually. The organization breeds its own dogs, but keeps its studs and bitches in foster homes. The school also recommends whelping at home. The pups are sent out to foster homes beginning at 6 weeks of age and remain there until they are approximately 15 months old. The dogs are then returned to the school to undergo 4 months of training.

Each dog will have a single trainer and undergoes daily concentrated training. At the end of the 4 month training period the dog is matched with a blind person. The 2 are then trained together for 4 weeks. The instructors must meet the same certification standards described for Guide Dogs for the Blind. Over 1,400 dogs are currently working. The average working life span is 8 to 9 years. The waiting time for a blind person to be assigned a dog is 6 months. The school produces about 50 guide dogs per year.Ω

International Narcotic Canine Consultant Service. Information packet. In possession of CPT Denzil F. Frost. The services offered by this organization include training assessments, canine reliability and certification, operational assessment, management orientation, canine narcotic detection seminars, development of evaluation/certification systems and basic narcotic detection course development.Ω

Jarvis, Lynn. Letter to CPT Denzil F. Frost, 9 November 1989. Dr. Jarvis explains that the sensitivity and selectivity of 'synthetic' sensors depend upon the interaction of vapors (odorants) with chemical coatings that are placed on the microsensor surfaces. These coatings interact more or less specifically with certain vapor phase chemicals or classes of chemicals. These coatings are analogous to the chemically different membranes, or receptors, that are present at the various olfactory receptor sites in the nose. Electronic sensors all utilize a probe device, such as an acoustic wave, optical wave guide, tunneling tip, and chemiresistor to measure the attenuation of surface acoustic waves, electrical conductivity changes, dielectric constant changes, changes in the index of refraction. The probe device transduces an electrical

current by converting the interaction of a vapor with a coating into an electrical signal that can be used to help identify and quantify the challenge vapor, or odorant. This is analogous to the chemical conversion of a chemical odorant molecule into an electrical signal that is then sent to the brain for analysis.

In microsensors, computers are used as analogues for the brain. Each sensor may be aligned in a number of different arrays, each with a different coating, or transducer, that will send its own signals from the several sensors (or olfactory receptor analogues) that then produces an array of data to analyze. The data is then analyzed using a number of recognition algorithms, or artificial intelligence schemes that indicate what vapors are present and at what level of concentration. There are numerous limitations to this approach of chemical detection, but there are also many areas of industrial and environmental monitoring in which it could be very useful. Some of the desirable characteristics of microsensors include their small size, sensitivity, speed, selectivity and microelectricity.Ω

Jennings, Paul B. Jr., COL. Veterinary Care of the Belgian Malinois Military Working Dog." 1990 Short Course on Military Veterinary Medicine. Washington, D. C., 2-6 April 1990. COL Jennings discusses the unique veterinary problems and breed peculiarities associated with the Belgian Malinois. Much of the information presented in this paper was collected and compiled by veterinary personnel assigned to the DODDC. COL Jennings states that the initial acquisition of this breed by the DODDC began in April of 1984, and that currently, the Belgian Malinois represents 79 per cent of the DODDC dog population (Andersen, Burwell).

He describes dogs belonging to this breed to be very intelligent, alert, high-strung, and that they require constant attention. As a result, COL Jennings feels that a lot of the medical/surgical problems seen in this breed can be traced to kenneling practices and the ensuing boredom associated with "down time". Peculiar problems listed by COL Jennings include: traumatic dental disease, (Reaver) tail beating, scrotal dermatitis, feet complications associated with soft distal pads, and interdigital lesions. He also discusses dietary problems associated with the Maximum Stress Diet in this breed (Dunlap), the incidence of spontaneous seizures, and respiratory problems linked to the use of choke chains. He also notes that the incidence of hip dysplasia and gastric dilatation/volvulus is similar to that seen in the German Shepherd. He further concludes that "the MWD Program has forced the Belgian Malinois on itself." He recommends that if this breed continues to dominate the procurement pool, changes need to be implemented in kennel management, training methods, and to ensure for prompt veterinary care.

Jepson, Paul. Letter to CPT Denzil F. Frost, 14 September 1982. LTC Jepson stated that the British Army does not breed its own dogs. A sufficient supply can be obtained from the general public. He mentions that many countries may not be as fortunate to have such a readily available source. The British military prefers males, and probably will not consider a breeding program until sex manipulation of litters becomes a realistic proposition, since half of the litter would be of little interest to the British military and the program would not benefit from the genetic improvement by progeny testing and selection of the best females.Ω

Jerszyk, Marion M. Letter to CPT Denzil F. Frost, 11 December 1989. Major cost factors pertaining to producing guide dogs at The Seeing Eye, Inc. are centered around the personnel hired to do the training. She also mentioned that the dogs become more valuable as they age and meet the health, temperament, size, and conformation criteria established by the organization.Ω

Jerszyk, Marion. Telephone interview, 4 December 1989. Dr. Jerszyk described the breeding program at The Seeing Eye, Inc. and said 80-90 per cent of all their dogs are bred on site. They stress population genetics and know very little about the individual pedigrees. They primarily select for hip structure and trainability. They use an 8 point grading system. The initial rejection rate when the pups are selected from the litters is 35-40 per cent. Once the dogs begin formal training to become guide dogs, the rejection rate falls to about 20 per cent. She mentioned that the Labrador breeds are more successful, but clients prefer the German Shepherd. She said a truly excellent German Shepherd cannot be beat, but they are quite rare. The average cost of a trained guide dog from The Seeing Eye, Inc. is \$18,000.00. She also mentioned that the instructors undergo a 2 year apprenticeship before they are eligible for certification.Ω

Johnson, Glen R. Letter to CPT Denzil F. Frost, 13 February 1990. Mr. Johnson enclosed with his letter a description of how he conducts temperament testing of young, sexually mature adults (≥ 9 months of age) that he uses for his own tracking operation. He states that the traits that he evaluates pertain specifically to service work, and that other intended uses of a dog would require developing a completely new

and appropriate temperament system. He says that dogs should not be tested without a specific and necessary reason for doing so. Mr. Johnson lists the following characteristics as the most important in a dog to be used in work involving human beings, such as protection, obedience, detection and "bitework." The characteristics are: bravery, courage, aggressiveness, gungniness, inclination to bite, recovery time, sovereignty, and confidence. He suggests that all evaluations should be done by at least 2 evaluators, and that the complete evaluation be fully documented. Specifics for evaluating each characteristic, and drawings of subjective facial expressions were also included. He concluded the letter by stating that he does not breed his own dogs, and that he had heard the U.S. Army once tried a breeding program, which "failed badly", due to either bad hips or bad temperament (Lees, Linn). He said this can be a disadvantage of inbreeding, but could possibly be minimized by outcrossing. He also referred the author to Dr. Fuller as a source of information.Ω

Johnston, Shirley D. Letter to CPT Denzil F. Frost, 26 October 1989. Dr. Johnston stated that she was not aware of any commercial application of embryo transfer in the dog, although she did refer the author to Dr. David Wildt, who has been conducting research on feline embryo transfer.Ω

K-9 Plus - Developing a Superior Military Dog. Video cassette. Division of Medical Audiovisual Services, Walter Reed Institute of Research. This videotape explains the history of the U.S. Army's attempt to develop a 'super' military dog, under the auspices of biosensor research. The tape explains how the program started, mentions why the German Shepherd was selected from 6 other breeds plus the mongrel to be the research

model. The objective was to identify superior animals and establish breeding lines through selective breeding. The tape discusses the selection criteria used, socialization , training and evaluation of the pups, and the phases of development identified during the first 12 months of a pup's life. The tape ends by stating that the main purpose of the program was breeding and not training (Fuller, McIntire, Sep 1968).

Kay, Debbie. Cassette tape addressed to CPT Denzil F. Frost. This tape is in response to a letter that the author sent to Ms. Kay requesting information about how she procured, trained and employed her dogs. The author discovered Ms. Kay's firm from an article written by Elinor Ohrn ("These Dogs Nose Around Some Very Dangerous Places"). Ms. Kay discusses the following topics: breeding, puppy raising and testing, training, selection criteria and the MWD Program. Ms. Kay emphasizes up front that dogs, like human beings, are individuals and as such there is a wide variety of working ability and temperament characteristics, even within a particular breed (Dennis). She makes this statement at the beginning of the tape to emphasize that prior to starting a breeding program a lot of time and effort must be devoted to studying the specific lines and breeds, for the stud and the bitch in order to confirm the reality of your end goals. She makes the statement that if the homework is done in a complete and thorough manner, it is possible to develop a breeding program that will result in 100 per cent of the progeny completing training. She refers to her own program, and those of many guide dog operations that have established specific attributes in temperament and working qualities that can be realized through genetics.

She later refers to crucial environmental factors also, but makes the point first that knowledgeable, and experienced people need to be involved at the beginning. She refers to this requirement as the art or intuitive dimension of working dog production. She also states that guidelines must be established, but that they must also be flexible. This is because the production of dogs, like the production of anything else, must obey the laws of normal distribution and comply to the bell curve described by those laws. The "experienced eye" and the flexibility of a training regimen will allow many of the dogs located to the right or left of the median to also be able to complete training, and thus minimize the number of incompatible dogs. She also states that regardless of the breeding system it would be almost impossible to obtain all dogs from a breeding program. She cites the practice of various guide dog programs, such as Seeing Eye and Guide Dogs For the Blind, who accept or procure from the outside. This again underwrites the importance of having experienced personnel who can procure dogs outside of the breeding colony that are comparable in quality.

Ms. Kay also comments that she has developed agreements with numerous guide dog organizations to accept her excess dogs. In this way her problem of disposal is lessened, not that she is dumping dogs of inferior quality, but that she can be very selective in her criteria for detection dogs, and those that do not meet the standards, for the most part, qualify and turn out to be very good guide dogs.

Ms. Kay next discusses the importance of economics in a breeding program, by saying that any program that is not economically feasible is doomed to fail. As a result, she states that you need to select prolific

bitches i.e. those that can average 10 pups per litter and 1.5 litters per year. She defines success in this area as requiring the following: 1) Selection of the proper breed lines; 2) Existence of a flexible training program; 3) Proper conducive environment for socialization and normal development. She states that if these criteria are met, it will not be unrealistic to project 100 per cent utilization of the progeny for the intended purposes of the breeding program. With respect to imprinting and training, Ms. Kay begins at day 1. For the first 7 weeks of the puppy's life, it is exposed to vocal or audible sounds and different smells. The pups are also taught kennel manners beginning at 7 weeks of age (Fenton; Ohrn, "When it Comes to...").

Ms. Kay also utilizes the puppy evaluation tests described by Scott and Pfaffenberger, and also the Campbell's Standard Puppy Aptitude Test. This last test allows for the individual formulation of how each pup is to be raised, according to its own unique personality. This test also is a good indication of what a particular pup's temperament will be as an adult. With proper raising a pup that may not score well in the Campbell's test may still turn out to be a very good detector dog if the dog is nurtured along as a youth. The Campbell's Standard Puppy Aptitude Test is comprised of 9 parts. They are: 1) Social attraction. This measures the degree of confidence. 2) Following tendency. This measures the degree of following attraction. 3) Restraint tendency. This measures the degree of dominant/submissive tendency. 4) Social dominance. This measures the degree of social dominance. 5) Elevation dominance. This measures the acceptance of a puppy by a dominant figure. 6) Retrieve test. This is a good indication of a dog's willingness

to work with humans. 7) Touch sensitivity. Dogs very greatly in sensitivity to touch and this test measures that sensitivity, and gives an indication of how much touch/force to use during training. 8) Sound sensitivity. This test is used by Ms. Kay to indicate the degree of leadership and intelligence of a dog. 9) Sight sensitivity. This test measures a dog's responses to strange objects. Ms. Kay places the most emphasis on numbers 6 and 8. Each part of this test is graded on a scale of 1 to 5, and according to Kay, any dog with an overall average score of 3 or less will make a very good detector dog. She references Humphrey and Warner's book, Working Dogs, 1934 as the best book she knows of that describes the physical attributes of ideal working dogs.

Once Ms. Kay outlined the preceding points, she addressed problems associated with the MWD Program, and the U.S. Customs program, and offered suggestions for improvement. Concerning the MWD Program, Ms. Kay discusses 5 major problems. They are: 1) the emphasis placed on titles and lineages that are based on paper only. She feels the military lacks the art of evaluating prospective dogs. 2) Relates to the large numbers of dogs required by the military. She feels that it is impossible to go out and expect to find say 200 dogs of the same quality in physique and temperament, simply because the breeders are not breeding toward a common goal. 3) The "military's rigid training program." It has very little flexibility to accommodate to the range of temperaments found in the dogs procured. 4) The concept of dual-purpose or cross-trained dogs. She sees no valid reason for a cross-trained dog. 5) The rotation of handlers, and the variation in enthusiasm among handlers. Ms. Kay stresses that it takes more than 1 year to develop the bond between the

handler and the dog, that is so essential to the effectiveness of the team. She also states that dogs have feelings too, and she has personally examined MWDs that were performing poorly and said that very often the history related to a change in handlers. She feels that the military must decide on a consistent, extended tour for the handlers, especially if they are enthusiastic, or change the training program and the missions assigned to the dog teams, because right now the rotation schedules and standards expected from the handler/dog teams are incompatible. She references that most police handler/dog teams live together 24 hours a day, and that is for the specific reasons stated above. Concerning the U.S. Coast Guard (Author's Note: Customs?), Ms. Kay thinks they go through an unnecessary number of dogs in order to find the right one because their training program is so narrow in scope. In other words, she feels there is no latitude or flexibility to accommodate the wide variety of temperaments in the dogs they procure from animal pounds and shelters. In addition, they have no idea about the backgrounds of these dogs and therefore have no idea at the beginning about the dog's true personality.

Ms. Kay ends by explaining that she prefers the food reward system over the play drive system for motivation because she feels the dog may become bored with playing, but hunger is a motivation associated with survival and thus will always be with the dog as long as it lives (Devaney, Fenton, Rimbey). Concerning the biosensor program, and based on what she has heard from various people associated with the program, it is her opinion that it was discontinued because the program was dominated with research-oriented personnel. And that there was no

over-all coordination, and there was significant jealousy between the various factions that came into play as the money began to dry up.Ω

Kelch, William J. "Canine Soldiers." Military Review, LXII (October 1982):

33-41. This article discusses the use of dogs during the Vietnam War from the perspective of prior roles and the unique challenges presented by Vietnam for the dog. The author concludes that many of the failures of the MWD in Vietnam were due to unrealistic expectations of a dog as a foolproof detection system.

Kiddy, C. A., D. S. Mitchell, D. J. Holt and H. W. Hawk. "Detection of Estrus -

Related Odors in Cows by Trained Dogs." Biology of Reproduction 19

(1978): 389-395. This article describes 7 experiments using bovine vaginal fluid, urine and reproductive tissue in an attempt to isolate the source of the distinctive odorant that indicates the presence of estrus.

Four German Shepherds and 2 Labrador Retrievers were used in the study, that all came from the DODDC. This article demonstrates the feasibility of using trained dogs to detect estrus in cows. The study concluded that there is a distinctive odor associated with estrus that is not present during proestrous or diestrous in dairy cattle. Further studies are proposed in order identify the specific odor and its source.

Kiddy, Charles A. and Daniel S. Mitchell. "Estrus - Related Odors in Cows:

Time of Occurrence." Journal of Dairy Science 64 (1981): 267-271. The purpose of this study was to determine when the estrous-distinctive odor appears, and to determine how long it lasts. This study also demonstrates the feasibility of training dogs to detect estrus commencement and duration in order to predict optimal fertilization. Success observed in this study led the investigators to examine optimal

training methods and breeds of dogs best suited for estrus detection. Practical methods of employing dogs to detect bovine estrus and identification of the odorous substances that signify initiation and termination of estrus are also discussed. The paper concludes that with the help of the dogs, the odors relating to the onset of estrus are present 3 days prior to onset, with intensity of the odor peaking on the day of estrus. The odor disappears 1 day after estrus.

Kilby, Edward. Letter to CPT Denzil F. Frost, 24 March 1990. This letter contained a brochure describing the Florida Search Dog Network (FSDN) and the Bloodhound Handbook published by the American Bloodhound Club. The brochure describes the activities of the organization and states that due to the lack of a standard for certification within the state of Florida, FSDN has established its own standards for certification in hopes that these criteria will serve as a template to certify future man-trailing dogs in Florida. The handbook gives a general description of the Bloodhound as a breed, basic hygiene and obedience considerations and a list of books about the breed.Ω

Kindel, Stephen. "Catching Terrorists." Science Digest, September 1986: 37-41, 76-82. This article discusses the full spectrum of technological capabilities available now to thwart terrorism. Kindel states that politics plays a dominant role in how technology is employed to impede terrorism.

Klein, Ehud, Sheldon A. Steinberg, Susan R. B. Weiss, Donna M. Mathews and Thomas W. Uhde. "The Relationship Between Genetic Deafness and Fear-Related Behaviors in Nervous Pointer Dogs." Physiology and Behavior, 43(1988): 307-312. This paper presents an association in nervous dogs

of abnormal behavior that could be attributed to deafness. They reported that 75 per cent of their dogs suffered bilateral deafness as demonstrated by complete absence of brain stem auditory evoked response. The paper also discussed implications for breeding animals for specific research in light of these findings.

Kraemer, Duane C. "Intra- and Interspecific Embryo Transfer." The Journal of Experimental Zoology, 228(1983): 363-371. This paper reviews the advances and state-of-the-art applications for 15 species of animals, to include the dog. Kraemer states that the ability to successfully hybridize is probably a reliable indication of compatibility for embryo transfer. The new technique of inner cell mass transfer is also discussed.Ω

Krauss Max. "Explosives Detecting Dogs." U.S. Army Land Warfare Laboratory, Aberdeen Proving Ground, Maryland. Technical Report No. 71-11. September 1971. This report substantiates the view that dogs are very capable of detecting explosives. However this report emphasizes that it is very important for the handler to understand the difference between instinctive and motivational behavior in order to recognize any regression in the dog's behavior to indicate detection of explosives. The study further states that the selection of handlers is a critical factor in the overall concept of an explosive detection team.

Kwei, G. I.. Memorandum. April 26, 1985. Subject: Bioanalytical Detection of Explosives. Los Alamos National Laboratory, Los Alamos, New Mexico 87545. This memorandum relates various bioanalytical techniques that have potential for detecting explosives in a rapid, reliable manner. They include light emitting indication reaction, TNT detection by light

emission and immunoassay, and TNT enzyme isolation. These techniques can be used for detection and quantification of nonbiological molecules such as the vapor, solid or liquid forms of TNT. These techniques also have a very high sensitivity and specificity, and could be developed into light portable detectors.

LeBaron, P., S. A. Simon and R. R. H. Anholt. Activation by Odorants of a Multistate Cation Channel From Olfactory Cilia. Proceedings, National Academy of Science, USA 85 (1988), Neurobiology: 944-947. Provides data to indicate that activation of ion channels by odorants may mediate excitation of the olfactory neuron.

Lacey, Robert C. "Loss of Genetic Diversity from Managed Populations: Interacting Effects of Drift, Mutation, Immigration, Selection, and Population Subdivision." Conservation Biology 1 (August, 1987): 143-158. This article describes the use of a computer to simulate the complex interactions of factors listed in the title of the article that affect hypothetical populations. Lacy concludes that genetic drift is the sole factor that contributes to the depletion of genetic variation in small populations, and that the effects of genetic drift can be counterbalanced by 1) Allowing for the introduction of occasional outside gene frequencies, and 2) By dividing the managed population into small groups that experience controlled introduction of gene frequencies between the groups. Lacy cautions that the biggest problem associated with 2) lies with the administration involved in the movement of animals between subpopulations. Lacy states that this movement of animals must be under strict control at all times in order to avoid the deleterious effects of inbreeding within each subpopulation (Bielfelt).

Laird, Robert D. "The Evolution of the Air Force DOD Dog Program and Detachment 37." Historical Office, Air Force Logistics Command, September 1979. As the title depicts, the report provides detailed information about the development of the MWD Program.

Lammers, William E. Letter to CPT Denzil F. Frost, 26 September 1989. Dr. Lammers states that during 1988, 43,000 dogs were impounded at the San Antonio, Texas Animal Control Facility. Thirty nine thousand were euthanized. Dr. Lammers mentions that he has served as a veterinarian in the Air Force since 1970 and has personal experience with the MWD Program and the DODDC. In his opinion, of the 39,000 dogs euthanized several 100 may have been suitable as MWD training. He also mentioned that procurement of dogs from facilities such as these would require careful medical screening.

Lancet, Doron. "Vertebrate Olfactory Reception." Ann. Rev. Neurosci. 9(1986): 329-355. This article reviews the anatomy of the olfactory sensory organs and ancillary structures, quantitative and qualitative measurements and the biochemistry of olfactory reception. This is the most comprehensive article found relating to the basic understanding of the many factors involved in the sense of smell.

Lanting, Fred. "Canine Intelligence and Care." Canine Chronicle (27 January 1990): 30, 32. Mr. Lanting presents a general, but comprehensive view of the importance of early stimuli for proper brain and nervous development. He emphasizes the importance of exposure to human contact, sounds, scents, sights "and things that go bump in the dark." He also discusses the significance of long-term potentiation and its positive influence on synaptic efficiency.Q

Lanting, Fred. Letter to CPT Denzil F. Frost, 8 March 1990. Mr. Lanting begins his letter by stating that he thinks the government has already shown that a breeding colony designed to produce MWDs will not work because it is too expensive, there is a high washout rate, and the problems associated with the disposal of the rejects. He also states that you buy a dog less than 18 months of age you cannot really identify those dogs that have a high probability of developing hip dysplasia. He states that approximately 30 per cent of the truly dysplastic dogs will be missed prior to 24 months of age. He further states that American dogs have the capability of being trained to be good working dogs, but they do not have the same intensity of drive and "hardness" as European dogs. He claims the dogs can be obtained within the U.S., but not at the prices the military wants to pay. He concludes by stating that the military has a fair method of testing and evaluating prospects but goes too much "by the manual," instead of relying on the expertise of a proven trainer (Fenton, Frost, Reaver).Ω

LeVine, Gary. Letter to CPT Denzil F. Frost, 13 March 1990. Mr. LeVine states that he raises 400 to 500 dogs per year as a dog breeder. He also says that he has developed his own special strain of working dog that is "highly intelligent, docile, has an excellent nose, and a perfect temperament." He claims that his dogs are quick learners, and they retain what they learn. He concludes his letter by emphasizing the importance of proper nutrition, veterinary care, breeding pool, foundation stock, and sanitation.Ω

Leber, Cathie. Letter to CPT Denzil F. Frost, 26 February 1990. Mrs. Leber states that the average cost of a guide dog at Guide Dogs of the Desert,

Inc. is \$8,000.00 to 10,000 dollars, of which only 50 per cent complete the training program. Mrs. Leber also included a brochure describing the organization, which was organized in 1972. All of the instructors are licensed by the California State Board of Guide Dogs for the Blind. The pups are placed in foster homes between 4-12 weeks of age and return when they are 12 - 18 months old. Emphasis during this time is on love, socialization and basic control, such as learning house manners, obedience commands and leash training. All of their dogs are AKC registered German Shepherds, Golden and Labrador Retrievers. They will occasionally accept a donated pup that is AKC registered, has at least a fair rating from a veterinarian or an OFA certification on the hip x-rays on the dam and sire of the donated puppy. The dog must also be healthy, and cannot be shy. Formal guide dog training takes 5-9 months. The student/instructor ratio is 3:1.Ω

Lees, George. Telephone interview, 23 February 1990. Dr. Lees related his experience with the biosensor program. The majority of the interview centered on why he thought the program was discontinued, and what were the lessons that can be learned for the future. Dr. Lees stated that the biosensor program meant different things to different people, and even the military community, outside of the project, really did not understand the potential of what was going on. He also thought the Director's concept of implementation by using the model of the cavalry remount system was antiquated. Also the general dog world saw no benefit to them, probably because they did not understand the concept either. He went on to say that the dog fancy community is very fragmented in their beliefs , and whatever they believe as individuals, they are willing to

discuss with anyone that will listen and convince them "that they are right and everybody else is crazy."

He concluded by stating, that in his opinion, there were 2 reasons why the biosensor program failed. First, there was no clear vision or target of who needed, or how to best utilize the dogs. Second, the research team became impatient due to unrealistic expectations from upper echelon leadership, and a tightening of the budget purse strings. This pressure led to cutting corners and shortening timelines, which in turn led to less dramatic or slower progress. Lees said this "set people up for disappointments and eroded the real progress," of what was being accomplished. He cited as an example the directive he received to start breeding 9 month old dogs in hopes of shortening the time to reach the 4th generation. He said it was very difficult to get the dogs seriously interested, even though technically they were adults.

For the lessons learned, Dr. Lees said that the military leadership must understand that production and procurement of a MWD is different than procurement of a gun tube or jet engine (Laird: 17-20). Historically, the military sponsors the research and development and then expects an outside organization to produce a finished product. He said this concept led to the closing down of the project. The leadership did not or could not understand that the military would also have to produce and field the final product (Biosensor, Gilbert, Linn, News Release).Ω

Leighton, Eldin A., Jeffrey M. Linn, Richard L. Wilham and M. W. Castleberry.

"A Genetic Study of Canine Hip Dysplasia." American Journal of Veterinary Research, 38(1977): 241-244. This paper reports the data accumulated from the biosensor program relating to pelvic radiographs

on 1,186 German Shepherds. The heritability estimate for hip dysplasia was reported to be 22.0 per cent, thus judged to be moderately heritable. Progeny testing designed to select against hip dysplasia was deemed to be essential for making progress towards lowering the frequency of hip dysplasia in dogs.Ω

Leighton, Eldin and Marion Jerszyk. Breeding Station Progress Report: 1976-1985. The Seeing Eye, Inc. This report concludes that the desired polygenic traits used for selection of breeding stock and trainability have been relatively easy to identify and accomplish due to implementation of computerized record keeping and systematic statistical measurements of breeding potential. The report states that long term improvement can only be achieved incrementally via consistently applying the principles of the breeding program over many generations.Ω

Leighton, Eldin A. Letter to CPT Denzil F. Frost, 4 December 1989. Dr. Leighton expresses encouragement for the undertaking of this thesis in hopes that the feasibility of establishing a MWD breeding colony will be realized by the military leadership. Dr. Leighton directed his remarks to artificial insemination (AI) and embryo transfer (ET). Dr., Leighton states that AI has only limited use as a technique for achieving greater genetic change per generation (Rankin, Sundgren). He says AI may be of some use during the start-up phase of a breeding program only, especially as a way to obtain germ plasm that cannot be imported in a whole dog. Embryo transfer, in his opinion, would play an even less important role in either a short- or long-term breeding program. Dr. Leighton argues that the dog is already quite prolific, and the art of ET is

most advanced for those species such as the cow, and the horse. He looks at ET as only a fad in which man is trying to "convert these 2 species into litter bearing creatures." (Authors Note: Refer to Rankin for an alternative opinion).Ω

Linn, Jeffrey M. Letter to BG Thomas G. Murane, VC, 10 January 1979.

Received from Jeffrey Linn. Dr. Linn summarizes the final disposition of the biosensor program, identifies the recipients of the breeding stock, and provides a flavor of the existing attitudes of personnel and organizations involved with the dissolution (Gilbert, Lees, Leighton).Ω

Lubow, Robert E. "Explosive Remnants of War: Detection Through the Use of Dogs." Explosive Remnants of War - Mitigating the Environmental Effects. Arthur H. Westing, ed. Stockholm International Peace Research Institute. 1985. This paper proposes the need for an international agency that would coordinate the deployment of dogs to countries that have experienced war, as post-war clearance devices. In order to be effective, Lubow emphasizes that agreements need to be made between the proposed agency and recognized institutions that maintain training facilities for canine explosive detection.

Mackenzie, Stephen A., E. A. B. Oltenacu and K. A. Houpt. "Canine Behavioral Genetics - A Review." Applied Animal Behaviour Science, 15(1986): 365-393. This paper provides an in-depth review of the study of behavioral genetics. The authors note that studies can be complicated by the effects of learning, genotype and environment. Due to the fact that breeders select for both physical and behavioral characteristics in the same individual, the authors include summary tables of reported relationships between physical and mental characteristics. The authors

conclude that puppy size may be an important factor in determining behavior, and that the progeny of superior performers are not necessarily superior to the progeny of average performers. They cite the Schutzhund scores as having a low heritability and thus are not an accurate reflection of genotype. In order to select more properly the authors suggest that scores be assigned by breeders before training starts.Ω

Mackenzie, Stephen A., Elizabeth A. B. Oitenacu and Eldin Leighton.

"Heritability Estimate for Temperament Scores in German Shepherd Dogs and Its Genetic Correlation with Hip Dysplasia." Behavior Genetics, 15(1985): 475-482. Temperament and hip dysplasia scores from 575 German Shepherd dogs from the biosensor program were used to develop heritability estimates for temperament and hip dysplasia, which were 0.51 and 0.26, respectively. The authors conclude that certain aspects of behavior are highly inheritable, and that selections on such behavioral characteristics are reliably reflective of genotype. This is apparently true even when the scores are subjective in nature. The authors warn that not all behavioral traits are highly heritable and that care should be taken in their selection.Ω

Mackenzie, S.A. and J.A. Schultz. "Frequency of Back-Tracking in the Tracking Dog." Applied Animal Behaviour Science, 17 (1987): 353-359. This article reports the results of 22 experienced tracking dogs as they approached a trail to determine the forward direction. The dog breeds used were the German Shepherd (20), Rottweiler (1), and the American Staffordshire Terrier (1). Sixty-six tracks were completed, and 60.6 per cent were followed by the dogs in the correct forward direction. The Authors concluded that standard training techniques do not take into

account the possibility of a dog following a track backwards, and they make the following suggestions: 1) The handler should develop tactics to compensate for the possibility of a dog back tracking, and 2) Training techniques should be developed to teach the dog to only follow in the forward direction. The study did not indicate whether or not the dogs were physiologically capable of detecting the direction of a track.Ω

Mackenzie, Stephen A. Letter to CPT Denzil F. Frost, 15 March 1990. Dr. Mackenzie is a strong advocate of a government-supported breeding kennel for the following reasons: 1) Due to the increased possibility of the next war taking place in a low intensity conflict scenario, the public may be unwilling to donate or sell the family protector because there will be no direct threat to our families here at home. 2) The procurement of dogs should be looked at the same way ammunition is. To ensure adequate quantity and quality of ammunition, the U.S. Armed Forces do not ask the civilian population to donate or sell its unwanted cartridges in hopes that a certain number of them will work. Just as the military learned long ago that it is very important to have control over the supply system to ensure the delivery of a quality product, so he feels nothing less should be expected with the production of MWDs. He feels that a government breeding kennel would provide that control. He also points out that the United States has some of the world's best veterinarians, geneticists, behaviorists, breeders and trainers. He states that the only thing that is lacking is a facility to put them all together. "It is a shame to waste all that talent." He continues by suggesting that a careful reexamining of the old cavalry remount system be conducted, with the hope that something similar for dogs could be

implemented (Lees). He states that there are many excellent dog breeders here in the U.S., who import quality breeding stock every year. He concludes by saying that we not only have the talent to operate a government kennel and training facility, but we also have access to breeding stock from around the world. He also mentions that he personally visited the Swedish Dog Center in 1982 and was very impressed. He states that this activity was producing 450 puppies per year in a closed colony, and to him, the dogs were very impressive. He also referred the author to Dr. Larry Meyers as an expert on canine olfaction.Ω

MacMurray, Michael. Letter to CPT Denzil F. Frost, 8 March 1990. Mr. MacMurray provided a copy of a briefing depicting the use of mine detector dogs to clear mines from the roads and countryside in Afghanistan. The report estimates that over 10 million mines were sown in Afghanistan, and the most economical method for recovery has been the dog. In the first 45-day deployment 14 dogs and 33 Afghans found and cleared almost 1,100 mines from 135 kilometers of road. The report concludes that buried land mines will remain a problem in Afghanistan for years to come. The report recommended that the U.N. organize and fund a full-scale mine detector program, to include breeding. Also included with the letter was Army DAMO-SC, Memorandum No. 156-88, 19 September 1988. This memorandum references tests conducted in 1975-1976 to determine field utilization of mine/explosive-detection dogs. The dogs were screened and trained at Southwest Research Institute. And although the dogs achieved detection percentages as high as 90 per cent, the U.S. Army declined to comment on the specific

aspects of using these dogs in Afghanistan, due to cultural acceptability, availability of large numbers of dogs, lack of results for long-term use of mine detector dogs, and the feasibility of using dogs to clear entire mine fields. MacMurray also states that the dogs currently being used for mine detection in Afghanistan were trained in Malaysia and Thailand.Ω

Marshall, D. A. "Olfactory Sensitization Studies." Smell and Taste Research Center and Department of Physiology, University of Pennsylvania, Philadelphia, Pennsylvania 19104. This is a very general, easy reading article that reviews the chronology of olfactory understanding.

Marz, Jean L. "Cloning Sheep and Cattle Embryos." Science, 239(January 1988): 463-464. This article reviews the advances for cloning embryos in ruminants and discusses the implications for application in different species of mammals, such as the mouse.

Mathews, Nancy. Letter to CPT Denzil F. Frost, 17 November 1989. This letter contained many informational brochures about the American Kennel Club, registration, guidelines for show conformation, and a nationwide survey of pet owners. Enclosed also was a listing of the number of dogs and litters registered for 1984, 1985, 1986, 1987 and 1988. According to these figures, a comparison between the numbers of German Shepherds in 1985 versus 1988 and the numbers of Belgian Malinois for the same period of time were 59, 450; 57, 139; and 74, 189, respectively.Ω

Mathews, Nancy. Letter to CPT Denzil F. Frost, 21 December 1989. This letter provided a listing of the recognized AKC collection/storage

facilities. Twenty-four were listed. The letter stated that AKC does not license, sponsor nor endorse these facilities.Ω

McCathern, Marge. Letter to CPT Denzil F. Frost, 18 December 1989. This letter contained information relating to the outstanding MILSTRIPS (requisitions) for FY 82 through FY 89. The information is listed for each category by year, and total for each year. The totals for each years are as follows, beginning with FY 82: 329; 376; 700; 749; 473; 515; 416; and 412, respectively (Andersen).Ω

McCathern, Marge. Letter to DCVS, Fort Leavenworth, KS. 13 July 1989.

This letter reports an average cost of 1,441.94 dollars for each dog procured (446) in 1989 by the DODDC. Factors included in this cost included acquisition, in-country transportation, travel (TDY costs), kennel rental, sever expenses, and final destination transportation.Ω

McCathern, Marge. Telephone interview, 1 December 1989. While discussing rejection rates in the MWD Program, Ms. McCathern said the rejection rate for the new explosive course was 83 per cent, and that it differs for each course. She also said the rejection rate at procurement was around 50 per cent. She advised the author to talk to Dr. Craig for the average costs involved in training each specialty of MWD.Ω

McDonald, Jack. Letter to CPT Denzil F. Frost, 2 April 1990. This letter contained numerous handouts describing various activities conducted by Mr. McDonald as they related to the training of working dogs. The following is a subject list of those handouts: Schedule and topic list of the Pierce County Sheriff's Department 1989 Fall K-9 Academy (conducted over a 3 month period), WAC 139-5-020 Requirements of Training for Police Dog Handler, Legal aspects of K-9 Application, K-9

Duties and Responsibilities, Washington State Police Canine Association
General Performance Standards, Early Life Management, Obedience on
Lead, Police Dog Protection and Safety, The Canine Mission and
Philosophy, Scoring Chart, Officer Selection, Dog Selection -
Temperament Testing, DDR Tests For Sharpness and Courage, 1st Annual
OPCA Training Seminar - Subject: Canine Selection (April 1984), Chapter
19, K-9 Units (Author Notes: This handout appears to have been
photocopied from a police department manual. Topics discussed include
policy, the selection process, K-9 unit training, records, and
recommendations), and Selection of a Police Dog.Q

McDowell, Edmund F. Jr. Letter to CPT Denzil F. Frost, 12 February 1990. Mr. McDowell states in his letter that the majority of the trainers employed by the Secret Service are retired U.S. Air Force personnel, who have brought many years of experience with them. He explained that once the Secret Service decides on the number of dogs it wants, the DODDC is notified and personnel from the Secret Service travel to Lackland to inspect and select the dogs desired for training. The selection criteria used for dogs by the Secret Service include the following: 1) Must be in good health, 2) Must have "active noses." 3) Must have a desire to play with a ball or take food from a handler. Mr. McDowell says these 2 characteristics indicate whether or not a reward system can be established for the dog. He feels the reward system is very important in motivating the dog to work. 4) Must be confident walking on slippery floors. He states that this is important because some dogs are not able to overcome their natural fears and adapt to a hostile environment. 5) Must react and behave well around people. This is because much of the

explosive detection work is done around people and they do not want a dog they cannot trust about snapping or biting (Dennis). He concludes by stating that most of their dogs are primarily explosive detectors, some of which may be cross-trained as patrol dogs. He does not foresee any reasons requiring a need to change the number of teams or their responsibilities.Ω

McEathron Gene. Letter to CPT Denzil F. Frost, 31 January 1990. This letter relates Mr. McEathron's experience as a working dog trainer for the USC (Caldwell). He states that at USC the instructors personally select the dogs for each course, which in turn minimizes the friction between the training and procurement personnel relating to problems that may arise as a dog experiences difficulty completing the course. Borderline dogs are not accepted, nor do they spend time going through a "charm school" designed to help them complete the course. Each dog is evaluated by least 12 separate evaluators who are not personally involved with the dog. Each evaluation lasts several days and strict records are kept. After graduation each dog must follow a mandatory training proficiency policy, and is evaluated annually by USC Headquarters training center staff. Any dog that cannot pass the annual recertification standards within 90 days is replaced.

Trainers are selected through national competition on a merit system. Mr. McEathron is a strong believer that a breeding program is not feasible, and that dogs should be selected at 18 to 24 months of age. The USC procures their dogs from animal shelters throughout the United States. He participated in the biosensor program and states that he can't imagine anything more being done to improve the quality of and dogs, and

yet he believes the rejection rate of these dogs was not less than for dogs procured through normal channels.

He attributes as a major factor for the high rejection rates seen today in the dogs procured in Europe the fact that the sellers know what the buyers want and are pretraining the dogs to satisfy the selection criteria (Reaver, Hayter, Frost, and Drexler).

Concerning dual-purpose versus single-purpose dogs, McEathron states that the Using Agencies would like dual-purpose dogs because they think they can get more for their money, while in fact the single-purpose dogs are more reliable and serious about what they are trained to do (Felt, Kay, Noll, Walbert). He ends by relating the development of the Air Force patrol dog concept in 1968. The objective of the concept was to produce a dog that could reliably scout, detect track, attack, hold, release, and protect the handler. In his opinion, the majority of the dogs graduating from the DODDC and many civilian training facilities have greatly diluted the significance of what a Patrol Dog means, and that this situation may not be discovered until a critical need arises in the field.Ω

McIntire, Roger W. "Behavioral Evaluation and Selection of Dogs for Army Training and Breeding." September 1968. NTIS Number AD 839544L.

This paper recommends that the army procure dogs that are either German Shepherds or Labrador Retrievers, due to their over-all greater sensory capabilities (K-9 Plus, Thomas). This recommendation was based on the emotional stability, responsiveness and above average sensory capabilities, which make these the best all-around breeds. Data to substantiate these recommendations is contained within the report.

It was also recommended that controllability and emotional stability be

consistently taken into consideration during evaluation, training, and day-to-day handling in order to facilitate efficient selection of high quality dogs. A further recommendation was to evaluate the Pointer's sensory capabilities and field control.

McIntire, Roger W. "The relative Effectiveness of Stressful and Rewarding Characteristics of Primary and Social Reinforcers in the Control of Canine Behavior." August 1967. DTIC Number AD 823920L. This paper reviews different procedures to train and evaluate canine behavior, the importance of discipline, comparisons between purebred dogs and mongrels, the influence of early socialization and the effects of consistent punishment and behavioral control. This author observed no differences between dogs that were trained at the earliest ages of weaning and those trained weeks to months after weaning. The author also concluded that the effects of selective breeding were not definitive. Punishment that was consistent and predictable was clearly demonstrated to eliminate undesirable behavior. The author observed that the effectiveness of a training method appears to be most efficient when the reinforcer is dependent on an effective setting and predictable behavior.

McIntosh, Allen K. and Coke L. Westbrook. A Review of the Military Dog Program. June 1968. CORG Memorandum CORG-M-353. Available from DTIC Number AD393957. The study identifies a lack of coordination between various programs involved with the military working dog program, and concludes that the needs of the military cannot responsively be met until the dog program is balanced by definitive lines of command and control and specified responsibilities delineated by

regulated guidance. The report also cites many references to the acceptability of the training methods and techniques found in FM 20-20: 52 (Burwell, Combined Arms Center).

Meyers, L. J. Letter to CPT Denzil F. Frost, 10 October 1989. This letter outlines proposed future research towards understanding basic canine olfaction, of which such studies have rarely been performed. Meyers reviews, in the accompanying white paper, the normal olfactory capability of dogs, differentiates olfactory capabilities between dogs, and alteration in olfactory acuity in dogs and other sensory capabilities of the dog, to include visual, auditory and gustatory. Also included with the letter was a white paper to N. Lynn Jarvis, dated 27 August 1987.Ω

Meyers, Lawrence J. Letter to CPT Denzil F. Frost, 8 January 1990. Dr. Meyers states in his letter that Auburn University has just recently submitted a proposal to the U.S. Government relating to research on the use of dogs for detection regarding the War on Drugs. He did describe 4 general areas upon which the research will concentrate. These were:

- 1) Selection criteria for dogs, to include temperament tests, sensory capabilities, and general health, with special emphasis on hip dysplasia;
- 2) Training methodologies, to include comparison of leading training methods, development of new methods, selection and training of handlers and influence of handler on dog performance;
- 3) Maintenance of dog handler efficacy, to include training maintenance-dog and handler, veterinary health systems, confinement systems including nutrition and certification;
- 4) Identification of what is being detected by detector dogs.Ω

Ministry Tape, U.S. Disciplinary Barracks (USDB). Video tape. This tape is included because it provides demographic information about the inmates at the USDB and may be useful when considering the option of using inmate labor for the socialization of puppies in a military kennel (Murphy). Ninety-nine percent of the inmates are high school graduates, and thus have a lot of potential to return to the civilian population. Sixty-three percent of the crimes committed were against people, with the majority involving sex crimes. Ninety percent complete parole versus a national average of 36 per cent for the state and federal penal institutions. The tape attributes the low return rate of the parolees to the extensive vocational training programs, of which there are 12. The USDB is fully accredited with the American Correctional Association. The tape mentions that only 19 per cent of the correctional institutions within the U.S are accredited with this organization (Murphy, Jeannette).

Mitchell, Daniel S. "Detection Techniques of Hand-Carried Canines." Final Technical Report, September 1973. DTIC Number AD527539. This report discusses the feasibility of using hand-held dogs to detect concealed weapons on persons circulating in crowded public environments. Five different breeds, involving 16 different dogs, were evaluated using detailed training protocols that are described in the paper. This paper is presented here not only because of the detailed training techniques, but also because Mitchell calls into question the claim or practice of not training young dogs. Training of the young dogs used in this study began at 3 to 4 months of age (Outman).

Mitchell, Daniel S. "Selection of Dogs for Land Mine and Booby Trap Detection Training." DTIC Number ADA 031980. This report provides a

detailed description of the factors considered in the selection process, to include, breed, sex, age, physical characteristics, medical considerations, olfactory acuity, auditory acuity, visual function, gunshyness, motivation, and temperament. The source of dogs, expected rejection rates and supplemental behavioral screening test are also discussed.

Mitchell, Daniel S. "Training and Evaluation of Mine/booby Trap Detector Canines." Interim Technical Report for the Period 1 July 1974 - 30 June 1975. Mobility Equipment Research and Development Center, Ft. Belvoir, Virginia. Contract No. DAAK02-73-C-0150. This report concluded that the contribution of mimicry or vicarious learning techniques was highly encouraging towards improving the efficiency of training in biodetector progeny, and that research should be directed at the development of more effective and efficient training techniques.

Mitchell, Daniel S. "User's Guide: Land Mine and Booby Trap Detector Dogs." Final Technical Report, Volume III. DTIC ADA 031982. This report is designed as a "hands on" manual to be used for review for the basic principles involved in dog handling. Correctional assistance for common behavioral problems is also included.

Mitchell, Thomas G. Letter to CPT Denzil F. Frost, 19 December 1989. Mr. Mitchell expressed in his letter a willingness to assist in anyway he could. He enclosed a resumé depicting his wide range of expertise, with special emphasis on Schutzhund training. He mentioned that one of the first things that needs to be accomplished was to assess current costs of procurement, standards and efficiency of evaluating and training a

MWD team for patrol, narcotics, bomb detection, and those for dual purposes.Ω

Mitchell, Thomas G. "Beginners Guide to Schutzhund." 1987. Received a photocopy of the book from Hildegard Brown. This book describes the tasks (protection, obedience and tracking) that must be accomplished in order for a dog to receive the Schutzhund certificate. Schutzhund is a German Word that means protection dog. This a sport designed to perfect 3 categories of the dog's natural instincts. Various titles are awarded for successful completion of specific tasks required for each category.Ω

Mohrman, Robert K. "Kennel Management." Purina Kennel News ® 1988 (Issue 3): 9-13. This article describes the lessons learned in construction and maintenance at the Purina kennels during the past 60 years. Topics discussed include computers and kennel management, personnel, kennel sanitation procedures and equipment, preventive medicine, vaccination, and internal and external parasite control. These were identified as the key factors for a successful operation. The article states that it is important to select personnel who are good observers, care about the comfort of the animals, and are willing to accept responsibility. Kennel design should facilitate easy cleaning, minimizing areas for entry and eliminating hiding places for insects and rodents. Concrete flooring is preferred. Portable power sprayers are most effective for sanitizing large kennel areas, whereas a brush and soapy water is sufficient for smaller kennels. The article states that all the genetics and proper nutrition can be adversely affected without a comprehensive preventive medicine program, to include vaccinations for

distemper hepatitis, leptospirosis, parvovirus, coronavirus and rabies on a regular basis as determined by a veterinarian. The article concludes by emphasizing that written procedures describing kennel programs should be available to personnel, and that an accurate record-keeping system should be used to maintain the necessary information on all dogs.

Moncrieff, R. W. "Quality Definition of Smell." Manufacturing Chemist. 26 (1955): 203-206. This article rejects the theory of olfaction being the result of chemical reactions and presents data to support a theory based on the absorption of odorants by the olfactory sensory fibers.

Moncrieff, R. W. The Chemical Senses. New York: Wiley, 1946. This book provides a general introduction into olfaction, olfactometry, the physiology of olfaction, Fechner's Law (relationship between stimulus intensity and the resultant sensation), gustation, chemical sensitivity of lower animals, the classification of odorants and their chemical constitution, and the theories of odor.

Morrow, David A. Current Therapy in Theriogenology 2 Ed. Helene E. Pazak. 2nd ed. Philadelphia: W. B. Saunders Company, 1986. This book contains 31 subsections on the diagnosis, treatment and prevention of reproductive disorders in the dog. The material is current, has been documented under controlled conditions, and is presented in a problem-oriented format. Practically all aspects of canine reproduction, for both sexes, is addressed, in addition to detailed discussion on the critical parameters that should be considered for establishing a breeding colony. (Author's Note: refer to Linn and Lees for additional information about prior attempts within the military to establish a military working dog breeding colony, and the lessons learned.)

Moskovskiy, O. Itkin V. "Together With a Dog." Pravda (1986): 2. DTIC AD-B116 836. This article describes the Central Military School of Service Dog Breeding, backgrounds of some of the personnel, training philosophy and the working dog in Soviet military operations.

Mueller, Lance A., MAJ. Letter to CPT Denzil F. Frost, 8 March 1990. MAJ

Mueller begins his letter by stating that the comments of his letter are his personal opinions and are not necessarily those of the Marine Corps. MAJ Mueller feels that the role of a MWD as an enhancement of law enforcement does not necessarily translate into effective combat utility of the MWD. Namely, the U.S. Marine Corps (USMC) has authorization for 63 Scout Dogs, but is unable to obtain them from the DODDC because there is no active training program. He states that after 3 years and much resistance, the USMC expects to receive 5 Scout Dog Teams by September 1990. He also mentions that they are short the authorized numbers of Patrol/Narcotic and Patrol/Explosive Dogs. He further states that the USMC will not accept Single-purpose MWDs because it is not an efficient use of manpower (Dennis, Folt, Walbert). He also feels that a breeding program has merit, but that the goal should not be to produce a super dog nor concentrate on any one breed of dog (Fuller). He recommended that the emphasis should concentrate on socialization, early scent imprinting, and develop a way of disposing, via sales, of the dogs that do not meet the standards for training. He also feels that it is not the intent of current directives, nor is it the most logical approach to procure dogs in Europe. MAJ Mueller also comments on the strengths and weaknesses of the MWD Program. He feels the training doctrine and safety standards are outstanding, but that the training program is much

too slow to meet the needs of the using agencies, and adapt to new procedures, or techniques. He feels that a well thought out plan to eliminate the backlog problem has never been developed, nor carried out. He states that no one will take responsibility for this problem, and each concerned party blames someone else for the problem (Parks). He also feels that the MWD Program has failed to develop an American market for the procurement of dogs, and that the program has failed to develop a wartime mission statement for the Dog Training Section, 3280th TCHTG. He concludes by saying that the final product is outstanding, but that production must be increased, an American market must be developed, and that the Air Force must respond to the changes and new requirements of the Using Agencies on a timely and cooperative manner.Q

Mueller, Larry. "Search and Rescue." Outdoor Life March 1986: 66, 67, 116, 118, 120. This article describes the activities and uses of search and rescue (SAR) teams throughout the U.S. At the printing of this article there were 48 such organizations, with each local unit composed of between 2 and 27 dog/handler teams. The article also references the National Association of Search and Rescue (Box 50178, Washington, D.C. 20004) as the group that coordinates handlers and dogs within the network. Both Purina and Kel Kan provide free dog food to the volunteer handlers, and Kel Kan also sponsors the SAR Dog Alert, a newsletter that is designed to share methods and ideas about training, handling, and unique situations and problems. The article also includes numerous actual accounts of how dogs are used to find people, dead or alive. Considerable time is also devoted to describing the 2 categories of SAR dogs: ground-scenting and air-scenting. The author of the article states

that for ground scents that are 30 hours or more old, the Bloodhound has no equal as a tracker; whereas a track that is less than 30 hours old may be equally followed by a Labrador Retriever. The importance of handlers being able to read their dog's responses is emphasized and cites the example of a dog "bitting" water. The author feels that this is the dog's way of studying the scent by taste, and references this conclusion by the actions of Labrador Retrievers seen biting the water and then diving to retrieve a duck in murky water. The author then concludes the article by illustrating the use of dogs to find drowning victims. Mueller states that scent from a drowning victim comes in 2 forms, 1) oils, that float to the surface of the water, and 2) water soluble liquids, solids and gases that are released into the air via evaporation. This second form is most easily picked up by the air-scenting dogs that then alert the handler by indicating where the scent is emerging from the water (Ashton, Syrotuck).

Mulligan, Herbert E. Letter to CPT Denzil F. Frost, 26 March 1990. Mr. Mulligan states that he has been conducting research relating to ways to improve the capabilities of working dogs for many years, and enclosed a bibliographic listing of over 450 entries. The majority of these listings come from working dog trade magazines. He states that the main strength of the MWD Program is in the caliber of its personnel. He attributes the primary weakness of said program to the lack of technical expertise. He feels that much of that expertise was lost after the end of the Vietnam War. He also states that the training course is too basic, and too short. He attributes the "fatal flaw" of the program to the denial of the existence of any other reference materials other the military

manuals. He feels that the MWD Program should use outside expertise as much as possible. To improve morale within the MWD Program, Mr. Mullican thinks there should be a special skill patch that would be unique to the elite personnel associated with MWDs. He makes this conclusion by observing this practice throughout civilian working dog programs. Mr. Mullican concludes his letter by offering to share his reference material and expertise upon request.Q

Murphy, Jeannette. Letter to CPT Denzil F. Frost, 20 March 1990. The letter contains a description of the Prison Pet Partnership Program at the Washington State Corrections Center for Women and the training programs used to train the dogs. The canine graduates are trained as hearing dogs, and service dogs that have been custom trained to meet the needs of people who are handicapped, in nursing homes, shut-ins and families with special needs. The program has been operation since 1982. All of the dogs come from animal shelters. The training program has been highly successful, and in 1985, it was awarded the prestigious Model Program Award of the international Delta Society. This letter is included here as an initial reference point relating to the feasibility of using prison labor to train dogs.Q

Murphy, R. B. "The Potential of Olfactory Reception for Ultrance Chemical Analysis." DTIC 1984. Presents studies conducted to expand the mechanistic knowledge about the biochemistry of olfaction in mammals.

Nakasone, Irene. Letter to CPT Denzil F. Frost, 11 December 1989. This letter contained information about the TNA explosive detection system produced by Science Applications International Corporation (Waldrop). This system can detect all known types of commercial and military

explosives, to include the Eastern Bloc composition SEMTEX. The company brochure stated that 2 systems are currently in operation at San Francisco and Los Angeles International airports. The shipping weight is 20,000 pounds. The operating temperature range is between 40° - 105° F. The price per copy, to include installation, is 1 million dollars. The letter is included to provide perspective to the capability and costs of technology to supplement or replace the dog as a detector.Ω

News Letter - Crescent. VOL VI. Editor: Dick Zimmerman. In addition to selling working dog supplies, this news letter is an excellent source for contacts throughout the world, new books, and training and operation philosophies.Ω

News Letter. "Genetic Breeding: Striving for Better Seeing Eye Dogs Through Science and Software." The Seeing Eye Guide 56(Fall 1989): 1-5. This article describes the emphasis placed on genetics to develop and sustain high quality dogs to be trained as guide dogs. Some of the breeding stock from the biosensor program went to this organization. In fact, the consulting geneticist at Seeing Eye was the geneticist for the biosensor program, Dr. Eldin Leighton. The article states that the software program used at Seeing Eye currently stores information on 58 traits for 3,000 dogs. This data goes back 5 years, and allows Dr. Leighton and Dr. Jerszyk to use statistical analyses to choose succeeding generations of breeders by examining the expected breeding values (EBV) for each dog considered. The EBV is the product of computer comparisons on hip and temperament scores on each dog considered for training, and its parents, grandparents and relatives. A lot of value is placed on the EBV to predict trainability and longevity as a guide dog.

According to the newsletter, progress is being made against hip dysplasia and improvement of temperament. The news letter says genetic progress can fluctuate, but eventually equilibrium is attained and improved quality becomes a reality. Both Leighton and Jerszyk predict that the best results are yet to come.

News Letter. Guide Dog News. A quarterly publication produced by Guide Dogs for the Blind, Inc.Q

News Release, Edgewood Arsenal, No. EA-573-71. This news release provides a detailed description of the biosensor program. The date of the release could not be determined. The release begins with a quote from the program chief, "That by 1980 we will have a remarkably superior dog." The release also ends with a quote from the same person, "If you think these second generation pups are something, then come back in few years and we'll show you a truly superior dog."(Biosensor, Gilbert, Lees, Linn, Whitstock)

Niemann, Wendell H. and Melvin L. Kreithen. "Training Dogs for Field Reconnaissance." DTIC Number 449411. Training methods and principles are described in this paper to illustrate how to produce trained reconnaissance dogs.

Nixon, Peter A. Letter to CPT Denzil F. Frost, 23 February 1990. Commander Nixon explains in his letter the use of dogs in the Australian State Police Force. He states that all police activities in Australia are carried out on a state basis. They have about 60 patrol dogs to cover an area about the size of 1/5 of the United States. He mentioned that the Police Dog Squad program began in the 1930's and continued until the mid 1950's when it was disbanded. He was in the first training course in 1980 when the

program started back up again. They began by procuring their dogs from a breeding foundation that was a private organization that provided the dogs at no cost to the police agencies. The breeding foundation was able to do this because a lot of its money came from the Federal Government. After the pups were approximately 12 weeks old, they were "put out to civilians to puppy walk" until the dogs were about a year old. The civilians were responsible for all upkeep of the dogs, and were required to attend regularly scheduled training sessions on how to groom and conduct minor training. He mentions that the quality of these dogs was generally quite good. As the demand for dogs grew, the breeding foundation could not meet demand, and at the same time the Federal Government withdrew its funds for support. As a consequence the breeding foundation folded, due to the above and the unwillingness of the police agencies to pay for the dogs they received. As result a "puppy walk and fostering scheme" was started. Basically, announcements were made to the general public about the need for dogs. Trainers and handlers were dispensed to the communities to examine dogs. If a dog was deemed to be of good quality, but too young the dog would be fostered out to a puppy walker. The puppy walkers paid for all of the costs associated with the dog. They tried to recruit dogs between 12 and 18 months of age. Usually, over 100 dogs had to be examined and evaluated before a suitable one could be found. Commander Nixon says that this was very time consuming and the quality of the dogs was highly variable, with excellent dogs rarely being found (Caldwell). He felt that they were taking dogs that other people did not want. He feels that a breeding and fostering program are the only way to go.

Concerning selection criteria, he feels that most dogs fail because of problems associated with temperament. He provided a list of criteria used by the Australian State Police for selection. They include: 1) Must be a male German Shepherd (purebred). 2) Must meet the conformation requirements of the German Shepherd. 3) Must have "fanatical retrieve." 4) Must be between 12-18 months old. 5) Must have correct temperament. 6) Must be in sound physical condition. 7) Must look like a German Shepherd. 8) Must not be gun shy. Q

Nolan, R. V. and D. L. Gravite. "Mine Detecting Canines." September 1977.

NTIS Number ADA 048748. This report discusses the selection of dogs, training and testing procedures, and the evaluation of test results. The report also compared the ability of dogs to detect mines to that of a metal mine detector (AN/PSS-11). The authors concluded that the overall ability of the dogs was greater than the mine detector. This was especially true around metal bridges, buildings, and vehicles. The authors also cited the dog's greater ability to adapt to a variety of environmental features. The report concludes with a statement that the authors were unable to assess the full detection capability of the dog due to a lack of funds (D'Ver).

Noll, Robert Letter to CPT Denzil F. Frost, 21 January 1990. Mr. Noll states in his letter that he prefers the Labrador Retriever, female spayed, about 16 to 24 months old. These animals go about their work without being distracted. The majority of the letter concentrates on what is wrong with the MWD Program. He states that there are many definitions of what a detector dog should be, but the biggest driving force behind the production of detector dogs at Lackland is the Federal Aviation

Administration (FAA). He estimates that they spend close to 100,000 dollars for one patrol-detector dog, and many of them cannot detect any amount of explosive less than 1 pound (Andersen, Burwell, Taylor, E.) He further states that behavior modification does not equate to training. He feels the DODDC needs a motivational training program. He further states that the DODDC has not kept up with the new training methods, nor even inquired into other programs. Mr. Noll is a firm proponent of the single-purpose working dog (Fält, Kay, McEathron). He also sees no reason to develop a 'superdog'; instead he thinks we should spend our efforts understanding the capabilities the dog now has, especially as it relates to olfaction (Fuller, Meyers).

Incl. with the letter was an information and training manual for explosive detection dogs from the New York City Police Department and the proceedings of the canine accelerant detection program, that was sponsored by the U.S. Department of Treasury, Bureau of Alcohol, Tobacco and Firearms, and the Connecticut State Police. These proceedings outline the basic guidelines for establishing an accelerant detector canine program, describe the accelerant detection canine proficiency test (blind testing) and provide a lot of news articles about the success of the program. The introductory remarks explain very clearly the reasons behind the use of dogs in arson detection work. Current technology is far behind in this type of field work.Ω

Noll, Robert. Letter to CPT Denzil F. Frost, 5 February 1990. This letter contained a photocopy of Puring Kennel News that describes the research being conducted by Dr. Larry Meyers at Auburn University on canine

olfaction. Mr. Noll recommended Dr. Meyers as a great source of information on current research regarding canine olfaction.Ω

Ohrn, Elinor. "Benjamin Hart - Behavior Savior to Present and Future Pets."

Purina Kennel News® 86 (Issue 4): 1-4. This article describes the contributions of Dr. Hart and his wife during the past 20 years to the understanding of canine behavior and how behavior problems can be treated, and prevented.Ω

Ohrn, Elinor. "BLOODHOUNDS; They May Look Funny, But They Sure Smell Good." Purina Kennel News® 87 (Issue 1): 2-4. This article describes the history of the Bloodhound and their utility to man. According to the article, the breed began around 2,000 B.C. The article also claims the Bloodhound's sense of smell is second to none, and that the low-hanging flesws and dewlaps sweep the ground trapping microscopic particles of odorant. They have been known to pick up a trail that is up to 8 days old. The majority of the article centers around cases where the Bloodhound has been used in search and rescue operations.Ω

Ohrn, Elinor. "In This Man's World, Smell Will Tell." Purina Kennel News® 89 (Issue 2): 1-3. This article describes the research being conducted by Dr. Larry Meyers on canine scenting capabilities (Author's Note: See Pugnetti: 43-45 for additional discussion). The article states that there are over 2 million working dogs in the U.S., and thus should be no wonder that people working with these dogs would like to know the olfactory capability of a particular dog and how to preserve or take care of the dog to insure that his olfactory senses are kept at peak performance. Conditioned response, the reflex behavioral response and the electrophysiological response are the methods mentioned in the article that

are used to quantify olfactory capability. The article describes Dr. Meyer's preference for electroencephalographic olfactometry as the method of choice. Meyers uses untrained dogs. The only requirement for these dogs is that they have been socialized, and are calm and free of stress. The article also mentions that Dr. Meyers has been called to testify before the Senate Commerce and Judiciary Committees about how dogs can be used to insure greater safety of airline passengers, and that he is actively involved in the formation of the International Society for Working Dogs.Ω

Ohrn, Elinor. "Those Dogs Nose Around in Some Very Dangerous Places."

Purina Kennel News® 88 (Issue 3): 1-5. This article describes the breeding and training of detector dogs at International Detector Dogs, Ltd. The owner and operator is Debbie Kay. She began by producing Chilbrook Labradors for the Seeing Eye Corp. in 1971. For reasons of intelligence, patience, and dedication to purpose, she prefers the Chilbrook line of Labradors for guide dog work. The article states that every dog sent to Seeing Eye completed the course. From her success for Seeing Eye, Inc., she decided to branch out into detection work. The article also mentions that the attributes needed for a good guide dog are basically the same as those needed for detection work, and although she prefers purebred Labradors, she maintains that any dog can be trained for detection work. The article states that she has rescued many dogs from animal shelters and transformed them into competent detector dogs. In fact, 1 of the 11 dogs used to protect the U.S Olympic Team in Seoul Korea was a "kennel save". This same dog is also used in her breeding program. Ms. Kay still donates dogs to the Seeing Eye Inc. The article

devotes considerable space to a description of the "scent wheel" and other devices and tasks used in the training of her dogs. Male and female dogs are used, although they are all neutered prior to the commencement of training. This organization has over 100 graduates distributed throughout the world. The article highlights a few of the more famous graduates. Ms. Kay also conducts seminars on how to train and use detector dogs.Ω

Ohrn, Elinor. "When It Comes to Hunting Dogs, Larry Mueller Has the Write Stuff." Purina Kennel News® 89 (Issue 1): 1-3. This article describes many of Larry Mueller's free-lance articles and books on outdoor life, and training dogs. The article states that Mueller starts training dogs as pups when they are eager to learn (Fenton, Thomlinson). He starts at 8 weeks of age because that is when the coyote pups start going out with the mother on short hunting trips. Mueller believes that this early training should not be scheduled, but revolve around those times when the pup is alert and eager to learn. He also believes in the value of socialization with man, and favors behavioral techniques over breaking techniques. The article also discusses Mueller's belief that dogs are place learners, therefore it is important to teach the same commands at different locations.Ω

Ohrn, Elinor. "When It Comes To Training Rescue Dogs, FINDERS ARE KEEPERS." Purina Kennel News® 84 (Issue 1): 1-4. This article describes the activities of various search and rescue (SAR) organizations throughout the U.S. At the printing there were 35 canine groups identified. The article states that dogs used for search and rescue operations must be able to endure grueling terrain, long hours, have a

strong sense of smell and a sound temperament. They must also be physically sound. Most of these dogs undergo extensive training in tracking and scenting. According to the article most dogs used are either German Shepherds or Bloodhounds, with the air scenting shepherds being preferred. The article explains that scenting seldom follows a straight course, and it is imperative that the handler be taught to understand and trust the dog and allow it to follow its nose, instincts and training. The author of the article visited the California Rescue Dog Association (CARDA) and describes the field exercises used to keep the dogs and handlers in top form.Q

Ohrn, Elinor. "Young German Judge Praises and Appraises Schutzhund, American-style." Purina Kennel News® 85 (Issue 3): 1-3. This article describes the growth of the Schutzhund sport in America, beginning in 1970. The sport began in Germany around 1900. The article describes the phases of the sport (protection, tracking and obedience), and the standards required to be a Schutzhund judge. To attain Schutzhund judgeship, one must be a training director of a Schutzhund dog club for 2 years, train 2 dogs to a Schutzhund III (the highest level) and 1 to an FH (master tracking) title. The applicant must also be the handler of a dog in a championship, be recommended as an apprentice, apprentice with a judge for 2 years, and pass a final examination. The article also portrays a visiting Schutzhund judge from West Germany. His name is Hans Freitag. At the printing of this article there were only 4 certified Schutzhund judges in America, only 1 of which was born here. Freitag starts training when the pups are 8 weeks old (Kay). This training mainly entails playing, socialization and evaluation for proper

temperament. Serious training begins when the pup is 8 months old. The article emphasizes that although the training is serious, it should be perceived by the dog as being fun. Brief mention of the strict control over the breeding of German Shepherds in West Germany is also discussed. No litter can receive the highest registry papers (pink), unless both parents have earned either a Schutzhund I or a herding dog title.Ω

Olsen, Patricia N. "Concerned About Euthanasia of Healthy, Homeless Animals." Letter. Journal of the American Veterinary Medical Association 196(January 1990): 10. Dr. Olsen states that this letter is the result of a question posed to her during a lecture to veterinary students on the overpopulation of pets in the U.S. and estimates of the national euthanasia rates of these unwanted animals. The student's question was, "How would the veterinary community respond to a disease that resulted in the annual death of between 12 and 25 per cent of all dogs and cats?" Dr. Olsen cites the Animal Shelter Reporting Study, 1987, American Humane Association, Denver to state that 6.3 to 10.4 million dogs are euthanized each year in the U.S. (Coile). This does not include those that die from exposure, trauma or are euthanized at veterinary clinics. Dr. Olsen said she told the student that the veterinary, research and pharmaceutical communities would surely unite to fight this terrible disease and find a cure. She then asks the question, "Why then, does our profession continue to accept the fact that between 1/10 and 1/4 of all dogs and cats in this country are killed annually because they do not have homes?" The letter ends by stating that she

hopes her profession will take a leading role against the death of healthy animals who do not have homes.Ω

Ormiston, Robert R. "Detector Dog Program." Foreign Animal Disease Report

14-2 (Summer 1986): 1, 2. The article describes the dog detector program sponsored by the United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, that began on 12 July 1984. The purpose of the program is to monitor passengers at international airports (4 at this printing) who may bring into the U.S. prohibited fruits and meats from foreign countries. All of the dogs are Beagles who wear distinctive green U.S. Department of Agriculture jackets. The dogs are all trained at the DODDC, and the article mentions that 6 additional detector teams will be assigned to other major airports. The article reports a success rate of 70 per cent, and that the dogs need to rest 20 minutes each hour for an 8 hour work day, at which time they are returned to the kennel. The article also states that sophisticated x-ray equipment is being installed at high-risk airports to enhance the ability of the USDA to intercept nondeclared, prohibited plant and animal products. Civil penalties of up to \$50.00 may be imposed for those passengers who fail to declare or attempt to smuggle these illegal items into the U.S.

Packard, A. S. "Origin of the American Varieties of the Dog." The American Naturalist 19(1885): 896-901. This article presents evidence, other than his own, to examine the multiple sources of the dog in the Americas.

Padgett, George. Telephone interview with CPT Kevin Anderson. CPT Anderson took this call from Dr. Padgett on the author's behalf. The following comments reference the notes he took during the interview.

The notes are in the possession of CPT Denzil F. Frost. Dr. Padgett states that currently veterinarians can expect to attain fertilization rates of approximately 35-40 per cent when using artificial insemination (vaginal implantation) in a clinic environment (Rankin). Concerning embryo transfer, Dr. Padgett states that extensive quality work has not been done. He attributed the paucity of hard data to the lack of incentives, such as money and demand (Adams, Rankin).Ω

Parks, Jim G. Letter to CPT Denzil F. Frost, 7 February 1990. Mr. Parks (MAJ, Ret) provides a personal perspective to the internal workings of the MWD Program. In order to avoid the impression of pointing fingers, only general conclusions and recommendations will be listed here. Mr. Parks states that from June 1981 to August 1983 he was in charge of the MWD Branch of the Security Police (SP) Academy, and from August 1983 to September 1984 he was in charge of the MWD Program at HQ, Air Force Office of Security Police. He also states that from late 1984 until 1987 he was on the fringes of the program but not directly involved. In early 1981 he was directed by the commander of the 3280th Group to determine why the Security Police Academy was being told by the field commanders that the Academy had a mission failure in not being able to meet the number of dogs stated in the requirements. Following a 6 month evaluation of the MWD Program he found the following problems:

- 1) recycling of dogs. Close to 50 dogs had been through 10 or more classes and were still being recycled in hopes of passing the training course. The philosophy was that any dog could be trained for any specialty if given enough time.
- 2) Lack of an aggressive buy program.
- 3) Many trained dogs could not be shipped out because of physical problems.

4) The Using Agencies had all increased their requirements for dogs and handlers, but were unwilling to provide the number of instructors/trainers needed to meet the stated requirements. Mr. Parks says the reasons for the problems were many, it depended on who you talked to (Fenton, Frost).

Based on these findings a number of changes were implemented, to include not allowing a dog to be recycled through more than one class without the specific permission of the SP Academy. Parks says it took almost one year to remove all of the untrainable dogs. He also mentions that during the same year the following policy changes were implemented: The DODDC was tasked to procure trained dogs, to start paying more for dogs in hopes that it would increase the number of quality dogs available for evaluation during the buying trips, the Dog Training Section was established (Frost), and the Using Agencies were put on notice that they would have to provide the manpower equal to the numbers of dogs and handlers they were requesting the system to produce.

Parks states that the next major problem incurred was the inability of the leadership to ensure an adequate pool of dogs be made available for training. He felt the number should be at least 100. He states that every downward trend had a major impact on the production of drug and bomb dogs because they were drawn from the best being produced from the Patrol Dog course. Parks notes that a major problem he found in 1981 that was still present in 1987 was that the SP Academy did not control the procurement of dogs. He equates this to not owning the engine that pulls the train. His opinion is that if the SP Academy "owned" the

complete program, it could move aggressively on the dog procurement problems and end the constant finger pointing when meetings were convened to resolve the problems (Mueller, Lance). Parks then states that while all of these problems were being addressed by the different concerned organizations, the Air Force decided they were only going to use dual-purpose dogs (Mueller, Lance; Walbert). This led the Army and later the Navy to do the same by 1982. Parks states that almost overnight the backlog of MILSTRIPS went from 200 to over 700 (McCathern, Letter, 18 Dec 1989; McEathron). This created a problem of what to do with the dogs that only could make it through the patrol or one of the detector courses, but not both. This led to an evaluation of the standards used to select dogs. Parks states that the standard for selecting the patrol dogs was improved but the standard for testing the potential to be trained as a detector dog remained the same. Parks says this was the result of a lack of communication between the different training and procurement organizations. He mentions that this was still true in 1987, and from what he hears, it is still true today. On one buying trip to Holland, for the company he works for now, he was told by the person selling dogs to DOD that no testing was being done to see what type of fetch drive a dog has for the ball.

Parks and others (Fenton, Frost, Hayter, Reaver) believe that using a ball as the reward instead of food plays a critical role in the success of a training program, and in the overall performance of a dog in the field. He references Dan Hayter's dislike of using food as a reward (Author's Note: See Kay for an alternative view.). Hayter demands a high fetch drive for a ball, and a willingness on the dog's part to work his heart out, in open

areas, buildings, and around vehicles. If the dog thinks it is playing instead of working for food he will learn and perform better. He suggests that maybe the reason why the MWD procurement personnel use food instead of the ball is because of the large numbers of dogs that need to be evaluated. He says this is not adequate justification. Parks says that if the testing is done right very few dogs will fail a training program. He mentions that his company began to have problems when they lost their experienced buyer in Holland and chose someone with less experience. He says they noticed an immediate increase in the failure rates.

Parks notices 2 other problems with the MWD Program which he feels contribute significantly to their inability to meet user demands: 1) Refusal to consider a civilian source to meet the increased requirements. Associated with this is the government policy to go with the lowest bidder, which in most cases will have the lower quality dogs (Author's Note: This is a dilemma throughout DOD; see Bunker for additional information). 2) The MWD Program does not build upon what the dog already knows. That is, Parks and his company do not spend weeks teaching the dogs English. They use the small number of Dutch or German commands. Park's organization sells dogs all over the world and the client uses the original command learned by the dog. He quotes the Statement of Needs that they receive from DOD which state that each dog must understand English commands. He feels the MWD Program is not benefiting from what these dogs have already been taught for over 2 years, and it does not make sense to him to make a dog go back to the basics and learn English commands. It only confuses the dog, and is a

waste of money if you pay for a partially trained dog and then attempt to completely retrain him.

He also notes, however, that a highly trained handler is as important as a highly trained dog. He states that it has always been a fact that there are untrained people training dogs in the MWD Program. He says that as untrained dogs are matched with untrained handlers, what tends to happen is that a problem dog gets all of the attention, while the rest just stand around. This results in an over balance of handlers compared to trained dogs. He also mentions a supervisor's course that requires a reduction of 4 weeks in both the patrol and drug detector courses. This means the handlers are spending more time in training, but returning to the field without a dog.

His recommendations for the MWD Program include: . . Establish a standard, and then standardize the evaluation process, and decide what you are looking for, i.e. dual or single purpose. 2) Once the concepts have been clarified, they must be sold to all participating personnel, agreed upon, and implemented. 3) Do not accept or retain borderline dogs. 4) Train the dog first and then match him to a handler. 5) Never allow quantity to be the driving factor. Quality must always come first. 6) Keep the "green" dog pool filled. He concludes by stating that the selection process will not guarantee total success, and there are no simple answers.Ω

Pesse, D. H. and D. H. Walker. "Odor Psychophysics in Vertebrates."

Neuroscience and Behavioral Reviews, 9 (1985): 431-467. This article consolidates all published data on olfactory chemoreception, by species,

methods used to train for olfactory detection, the stimuli used, and the results, both in tabular and narrative form, to include the dog.

Patterson, Donald. Telephone interview, 11 December 1989. Dr. Patterson described his expertise as being in biochemical genetics, directed specifically to genetic diseases of the dog and the cat, which are homologous to humans. He is also involved in gene transfer studies. He described behavior genetics as a "black box", and said that no single gene has been identified to affect behavior. In order to determine if such genes exist, he said one would have to start with simple organisms. He mentioned that he is a consultant to The Seeing Eye, Inc., and mentioned that they got started as an outgrowth from returning service dogs during World War II. He stated that the behavior characteristics for guide dogs are not very different from those of MWDs, and implied that there was ample expertise in these organizations to answer any questions pertaining to the MWD Program. He even commented that should the military come to Seeing Eye for assistance, the circle would then be complete (Whitstock). He ended by saying that Dr. Eldin Leighton is the expert canine geneticist in the United States, and probably the world. He stated that everything one would want to know about the feasibility of setting up a MWD breeding colony is already known by Dr. Leighton. This is not only because of his experience with the biosensor program, but also because of the work he has done since 1976.Q

Pfaffenberger, Clarence J., John P. Scott, John L. Fuller, Benson E. Ginsburg and Sherman W. Bielfelt. Guide Dogs for the Blind: their selection, development, and training. New York: Elsevier Scientific Publishing Company, 1976. This is one of the few comprehensive books

(Scott) that describes in detail what is required to "start from scratch" and develop a dog operation. Even though the book concerns itself solely with guide dogs, the same principals of genetics, socialization, and day-to-day operation would still apply. The big difference would be in the types of traits selected for. This book contains a very descriptive graph on page 21 that reflects sequential development and the critical periods of socialization in the dog (Appendix E, Wolfe).

Pfaffenberger, Clarence J. The New Knowledge of Dog Behavior. Howell Book House Inc., New York, 1965. This book relates Pfaffenberger's experiences in establishing Guide Dogs for the Blind in San Rafael, California, to include specific details on the establishment of their breed lines, puppy selection tests, socialization procedures and the complete operation. J. P. Scott assisted as an advisor.

Pfaffenberger, C. J. and J. P. Scott. "The Relationship Between Delayed Socialization and Trainability in Guide Dogs." The Journal of Genetic Psychology 95(1959): 145-155. This study was initiated to determine why dogs for the blind frequently fail during training at one year of age. The study includes data collected from 249 puppies that underwent aptitude tests, under varying environmental situations, when they were 8 weeks old. The tests lasted 4 weeks. It was concluded that heredity and early experience were the primary causes for the trainee failures.

Platz, Carroll. Letter to CPT Denzil F. Frost, 13 December 1989. This letter contains a product description letter from International Canine Semen Bank, and a description of the types of services available with respect to canine semen collection, storage, and artificial insemination. Q

Pouliot, Michele L. Letter to CPT Denzil F. Frost, 8 December, 1989. This letter describes the training program at Guide Dogs For The Blind. This organization has 21 guide dog instructors on staff, with over half being apprentices. An apprenticeship is monitored by law in the state of California and leads to state licensure after 3 years. During this time the apprentices are also being trained by experienced licensed instructors. Each instructor is in charge of training approximately 12 dogs.

During the training of the dogs, specific goals must be met. All dogs are tested at least 2 times during the 5 month training period. There are 4 training supervisors who oversee and "trouble shoot" the complete training program. They also make sure an instructor does not become "protective" of their work with a specific dog and begin to believe that their way is the only way. Specific techniques, that are time-proven, are used by all instructors.

There are other techniques that are absolutely prohibited, regardless of the confidence of an instructor to make them work. Ms. Pouliot mentions that since they are working in the public, they are very sensitive to avoiding training techniques that may seem abusive or draw too much attention to the trainer. Weekly progress reports are completed on each dogs for which an instructor has responsibility. These reports are then turned in to the training supervisors. If a particular trainer is not making adequate progress with a particular dog, that dog is assigned to another instructor. She states explicitly, "Egos have no place in this business." She said it is very common for a trainer to observe the newly assigned trainer and his different approach with the dog to learn more

from the same situation in the future. Additional benefits of the weekly reports are that they force the trainers to improve their skills because they must analyze the work problems enough to be able to verbalize and explain it. "Otherwise the problem can be ignored and not really dealt with."Ω

Pugnetti, Gino. Guide to Dogs. Ed. Elizabeth Meriwether Schuler. New York: Simon and Schuster, 1980. This book provides general descriptions for most of the dog breeds throughout the world today. Pugnetti also devotes approximately 50 pages to a discussion on the evolution of the dog and its lengthy association with man.

Rankin, Grady. Letter to CPT Denzil F. Frost, 12 December 1989. This letter contains a description of International Canine Genetics, Inc., and an initial outline of how this organization could support research directed toward determining the feasibility of using artificial insemination and embryo transfer to establish a breeding colony of MWDs (Concannon; Leighton; Scott, Letter; Sundgren). Mr. Rankin states that his company is unique in its focus on canine reproduction and would be highly qualified to carry out such an endeavor to produce high quality dogs for a continuous long term project.Ω

Rankin, Grady. Telephone interview, 7 December 1989. Mr. Rankin stated that they achieve greater than 70 per cent conception rates with vaginal implantation, and that they are working on systems for ovulation and pregnancy detection, and paternity testing (Padgett). He also said that within a year they will be able to provide frozen canine semen from Spain, Federal Republic of Germany, France, Italy, and Switzerland. He mentioned that the American Kennel Club (AKC) does not yet recognize

litters from overseas frozen semen, and this is a major constraint for those breeders who may want to tap into the European show dog gene pool. He also mentioned that they have a cryobiologist on staff and they are developing the embryo transfer technology. Currently the biggest problem associated with embryo transfer is to be able to reliably and consistently bring the bitch into fertile estrus via a hormonal protocol. It can be done now, but the success rates are not yet adequate. The AKC also has not addressed the issue of recognizing litters from frozen embryos. He also mentioned their willingness to conduct pilot projects to determine the feasibility using such technology in a MWD breeding program, and that such research could be funded by the DOD Program Solicitation For Small Business Innovation Research program. He stated that he would be very willing to present seminars to demonstrate his company's capabilities and resources.Ω

Rankin, Grady. Telephone interview, 21 December 1989. Mr Rankin discussed in more detail how his firm could develop pilot projects relating to the establishment of a breeding/imported genetic base, collect semen from star MWD performers in the field, work with trainers and Using Agencies to establish performance criteria on how to evaluate the dogs, decide on what litter characteristics should be emphasized, and develop a world-wide semen bank. He estimated it would take 18 months to acquire the specific breeds, breed and begin raising the pups. He emphasized that specific milestones would need to be established up front. He stated that he was quite sure the cost per dog would be less than the average purchasing cost of \$1,442.00 that was quoted at the Council of Colonels meeting in May 1989 (Combined

Arms Center). He calculated that based on a bitch cycling every 7 months, an expected 8 viable pups per litter, and an artificial insemination conception rate of 70 per cent, should result in an average of 10 pups per bitch per year. He said a goal of 50 pups per month would equate out to 600 per year. He figured it would take around 60 bitches and a small number of males, with minimal capital expenditure, since they already have the resources and facilities (Adams; Goddard, Letter).^Q

Rankin, R. Grady. Letter to CPT Denzil F. Frost, 2 January 1990. Mr. Rankin enclosed a preliminary proposal for the development of a breeding colony to supply dogs to the military. This proposal lists the resources of his company, Canine International Genetics, Inc. (ICG) and provides specific options designed to provide a consistent, high quality supply of dogs. As the title of the organization indicates, Mr. Rankin has access to canine semen banks throughout the world, and in particular for Europe.^Q

Rankin, R. Grady. Letter to CPT Denzil F. Frost, 21 December 1989. This letter contains information about the organization, Canine International Genetics, and the qualifications of the scientific and advisory staff.^Q

Reardon, Michael, F. COL. Letter to CPT Denzil F. Frost, 3 November 1989. COL Reardon refers to his background in contracting and emphasizes in his letter the importance of cost identification, benefits to be derived, level of government participation, and many other factors that must be considered to determine the best course of action. He suggests that the objectives and definitions of the MWD missions be clear, realistic, and minimal. More than one type of dog needs to also be seriously considered and weighed against "the probability of producing a very high quality animal for a focused set of tasks."^Q

Reaver, David. Cassette tape addressed to CPT Denzil F. Frost. Mr. Reaver relates his experience as a working dog trainer. He began training dogs as a hobby in 1960. As the demand for dogs increased, he started Alderhorst Kennels in 1975. The demand for working dogs really began to increase in the late 70's. Mr. Reaver lived in Germany for 4 years, and while there developed contacts with dog brokers and studied the German methods of training dogs. He started importing dogs from Europe in 1975. Most of these dogs were German Shepherds (GS). In 1981-82 he was importing 25-30 per year.

Currently, he is importing over 1,000 dogs per year, of which 80 per cent are GS. This works out to approximately 10 trips per year. The Belgian Malinois comprises the remainder of his imports (Burwell, Jennings). Reaver only buys dogs that have the Schutzhund title from Germany or the KNPV title from Holland. The possession of one of these titles by a dog means less time will be required to train a dog upon arrival in the U.S., and the rejection rates are minimal. This in turn lowers the operational costs, not only for the trainer but also for the purchaser of the trained dog. He mentioned that he may have to travel 2-3,000 kilometers to find 10 good dogs. With the opening up of the East Bloc countries, he says there is now a tremendous supply of top quality dogs. Apparently the East Europeans have more strict guidelines that are designed to preserve the top quality working dog lines. Reaver states that the training titles are only part of the reason he buys his dogs in Europe.

The other reason is because since the late 1800's the Europeans have maintained separate lines of dogs for either working or show. He

compares this practice to the U.S. and states that neither purpose is distinct, and in fact the working characteristics have been greatly diluted over the years in favor of the show attributes. He states that this is particularly true for the GS. The selection/evaluation procedures used by Mr. Reaver center around the presence of a high, pronounced play drive, coupled with a good social temperament (Kay). He does not want an over-aggressive dog nor a one-man dog. With the Belgian Malinois, this can be more of a problem because the Malinois tends to be a one-man dog. This means it takes about 2-3 weeks back in the U.S. for this breed of dog to adjust to a new handler, whereas for a GS it usually only takes 2-3 days. Mr. Reaver also stated that when he evaluates a Belgian Malinois, he will select one that has a good drive because a Malinois with a high drive can be very difficult to handle. He feels that this may be a reason for the high rejection rates, i.e. the inexperience of the young airmen at Lackland could not hope to handle a highly driven Belgian Malinois (Jennings).

Reaver feels that if the military wants a dual-purpose dog, then the Belgian Malinois would be the ideal breed. His operation sells a lot of these dogs to the border patrol, because they can remain successful for long periods of time. This is because of the high play drive. Reaver knows of no other breed that can match the sustained activity of this breed. He equates this observation to a strong endorsement for the Belgian Malinois in a working environment. However, Reaver cautions that the Belgian Malinois is not without its faults (Jennings).

Missing/brittle teeth are most significant problems associated with this breed. He states that it's rare to find a 3 year old without missing

or broken teeth. He does not know whether this is due to poor nutrition or genetics, or a combination of the 2. He claims that the typical breeder does not show concern or appear to be aware of the problem. He feels that this may spell the down fall of this breed unless the etiology of this problem is identified and measures are taken to improve this condition (Jennings). In spite of the absence of conformation standards in Holland for this breed, spondylosis in the Belgian Malinois is very rare. Whereas Reaver expects to find spondylosis in 80 per cent of the German Shepherds by the age of 8 years. For these reasons he expects a GS to have a working life of about 8 years, and 10 years for a Belgian Malinois (Fact Sheet).

Mr. Reaver's prices for a trained explosive or narcotics dog + 4 weeks training with the handler is approximately 4,000 dollars (Andersen, Burwell, Drexler, Taylor, E.). Concerning the MWD Program Reaver feels the primary problem is the unwillingness to pay a little more for a top quality dog. He thinks the MWD procurement center is a waste of money. All you need is an honest, competent broker. Although he did mention he was planning to establish a permanent buying center either in Holland or West Germany in the Summer of 90. Mr. Reaver mentioned that back in late 1988, 2 Majors from the Air Force came by to visit his facility and they spent over 5 hours discussing his operation. He mentioned, as he did to the officers, that he would be more than willing to give of his time, expertise and money to assist in any way he could, simply he said, "because I am an American and I want the military to have a top quality program." He even offered to go to Europe and assist in procuring the dogs.Q

Ridgway, Sam H. "Navy Marine Mammals." Science 243(1989): 875. This letter explains the use of dolphins by the U.S. Navy. The author of the letter explains the Navy's desire for openness toward dissemination of information about the dolphin program. The U.S. Navy uses up to 25 dolphins per year for world-wide operations, to include the Persian Gulf. The dolphins perform their tasks while swimming free and are reported by the author to return home to the ship once a task is completed. (Art and Entertainment).

Rimbey, Glen. Letter to CPT Denzil F. Frost, 12 March 1990. Major Rimbey describes the K-9 program at the Penitentiary of New Mexico as a full scale operation that involves the detection of drugs, explosives and cadavers, man trailing and crowd control. He uses Rottweilers and German Shepherds for crowd control, Labrador Retrievers for narcotic and explosive detection, and Bloodhounds for mantrailing and cadaver detection. Major Rimbey says he selects the dogs from working parents, not show dogs. He states that a dog must to be "aggressive toward his task, good attention span, not shy and happy." He feels that the Bloodhound is a necessity when trailing people, for which he says the Bloodhound is second to none. He also feels that by breeding your own dogs you have the advantage of early selection and knowing the breeding stock. He feels that you can breed into a dog aggressive drive and intensity. The main disadvantages are time in preparation and expense. He concludes by emphasizing that dogs are like people in that they are all different and sometimes you may need to use different training techniques on different dogs, and this may not be a feasible option for a large operation like the MWD Program. He believes strongly in the

"praise method" of training, and that by using this method "a dog will do his utmost to please you." (Devaney, Fenton, Kay)Ω

Risch, Erna and Chester L. Kieffer. The Quartermaster Corps: Organization, Supply and Services. Office of the Chief of Military History (1955): 323-337. This article describes the development of Dogs for Defense and gives an accounting of this national organization throughout World War II. It also provides evidence for the Army's decision to recognize that dogs possessed sufficient tactical value to justify their inclusion in regular peacetime units.

Ritter, Joan. Telephone interview, 4 December 1989. Ms. Ritter said the average cost of a guide dog from Guide Dogs for the Blind is \$12,000.00. She went on to describe the production sequence, that starts with the breeding and whelping programs. The pups then undergo socialization for 3 months, are evaluated and then are sent out to foster homes. The rejection rate from the initial evaluation is 40-50 per cent. There is a long waiting list for these dogs, who mostly will be used as house pets. The pups return from the foster homes at the age of 15-18 months of age. At this time they go through 5 months of obedience training with a certified instructor, who may also have an apprentice. The dog is then matched with a blind person and they both undergo 1 month training. The blind person lives with the dog at the training center during this time.Ω

Robb, Judy. Letter CPT Denzil F. Frost, 22 March 1990. Mrs. Robb begins her letter by stating that she feels one can have a show dog and a working dog "all wrapped up in one." She feels that "soundness of mind and body are of the utmost importance. When selecting a puppy, she looks for the pup that is the most outgoing, is curious, independent and is constantly

using his nose. She also wants a dog with a big nose and large nostrils. She starts selecting her puppies when they are 3 weeks old by moving the food bowl around and recording which pups use their noses to find the bowl. Olfactory capability, intelligence, dedication to humans and a strong desire to please are the characteristics she looks for in adult dogs. The most sensitive nose, discriminatory scent capability and stamina on the track are the attributes of the Bloodhound that Robb feels make this breed unique. She writes that her dogs have participated on homicides, kidnappings, burglaries, sexual attacks and many missing and lost person searches. She feels that the Bloodhound is particularly good for sexual attacks and in locating drowning victims. She concludes by stating that man has only begun to appreciate the tip of the iceberg relating to the dog's detection capabilities.Ω

Roberts, Douglas. Letter to CPT Denzil F. Frost, 1 January 1990. This letter contains a description of The Seeing Eye program. The process begins with choosing the appropriate breeding stock. See Leighton and Jerzyk, and News letter for a more detailed description of this activity. This organization also utilizes the 4-H organization to socialize their dogs. They consider this activity crucial to their success. Each 4-H member receives a manual outlining the specifics of what should be accomplished during the pup's stay with a 4-H member. The dogs return to the school between 14 to 18 months of age. There are 4 teams of 4 instructors who work on a 4 month rotating basis. The training system is designed to have 25 to 30 dogs prepared for selection with 18 blind people. Each stage of instruction is dependent on the previous stages. Prior to training, approximately 20 per cent of the dogs procured are rejected.

Once training commences the rejection rate is 10 to 12 per cent. In addition to their breeding program, The Seeing Eye procures stock from outside sources. They can purchase pups or adults. From this group approximately 30 per cent are rejected once training is started.Ω

Robinson, Russell D. Letter to CPT Denzil F. Frost, 18 January 1990. Mr.

Robinson states that Hazelton mainly breeds Beagles and hounds, that are shipped to research facilities at around 5-7 months of age. Their primary challenge is producing consistent even-tempered dogs. They have a two-fold program to accomplish this. First, and most important is the genetic selection for broodstock. Mr. Robinson states that this requires an extensive amount of categorization and computer tracking of potential pairings. The second aspect involves the socialization program, which he mentions they are currently in the process of redeveloping. In fact, he says both programs are in a continual state of development. He concludes by recommending that before anyone commences such an ambitious program, as much information, from as many sources as possible, should be obtained.Ω

Rogers, Richard O. Letter to CPT Denzil F. Frost, 20 December 1989. Mr.

Rogers states that he looks for the following when evaluating a dog: temperament, protective but controllable; appearance and size, looks like a shepherd, ears erect, weighs at least 70 pounds; confident on slippery floors and stairways. If a dog passes these tests, he is brought to the training center for further evaluation, to include the following: Test of courage in strange surroundings, this would include agitation along a fence, test for gunshyness, gun fired approximately 100 yards away; test again for strong retrieve drive. If the dog passes all of these

tests, he is then x-rayed and given a complete physical examination. The preferred age is 1-3 years. Rogers states that 85 per cent of the dogs evaluated fail, and only 10 per cent of those selected are unable to complete the 14 week training course. He states that the critical factor that guarantees success is proper selection of the dogs. The main problem in achieving consistent success are the breeders, who know what the evaluation tests are and train the dogs to successfully pass the tests. He emphasizes that it is very important to have evaluators with a lot of experience and a keen eye (Kay). He also mentioned that when he worked for the Washington D.C. Metropolitan Police Department they received 2 dogs from the biosensor program to train. Both dogs washed out.Ω

Rose-Pehrsson, Susan L., David S. Ballantine, Jr., and Pete C. Jurs.

"Detection of Hazardous Vapors Including Mixtures Using Pattern Recognition Analysis of Responses from Surface Acoustic Waves Devices." Analytical Chemistry, 60 (1988): 2801-2811. This article demonstrates the current capability of surface acoustic wave devices to selectively monitor or detect hazardous vapors at sub-per-million concentrations in ambient air. However, 8 separate sensors were required to be able to identify all of the hazardous vapors present in the experimental mixtures. Improvement in pattern recognition techniques is expected to continually increase. Dependence on strict control of sensor temperature and a truly inert reference point are currently the 2 major impediments to further significant improvement of this technology.

Sales, M., F. Borelli, and S. Annaratone. A Study of the Relationship Between Stimulus and Smell Sensations - Application to Gas Odorization.

Translation No. 07272/BG/LRS/LRST 781. 10th International Gas Industry Conference, Hamburg, 1967. Provides a mathematical model to the Weber-Fechner Law which states that the strength of sensation is in direct proportion to the logarithm of the stimulus. The curve developed by the model facilitates greater approximations of low and high concentration of a specific odorous chemical in vapor form. As a result, more exact threshold values can be determined.

Santiago, Marsha H. "Beagles Track Hidden Household Pests." Engineer Update, U.S. Army Corps of Engineers. 14(January 1990): 4. This article relates the novel use of Beagle dogs to detect termites, carpenter ants, powderpost beetles and other wood-destroying insects in government housing. The owner of the company, Robert Outman, an animal behaviorist, prefers Beagles because they scored highest on his selection tests, and due to their small size they can access small areas. The article reports that Outman only selects puppies with passive defense reflexes. If someone steps on a foot, the dogs will not growl or bite. Outman also begins extensive training and conditioning at 5 weeks of age (Fenton). This training lasts until the dog is ready to go into the field at 1 year of age.

Schroeder, Penny. Telephone interview, 29 March 1990. Mrs. Schroeder states that she tried breeding Bloodhounds for about 4 years before deciding that it was much better, and easier, to study blood lines and go out and procure what you want. She feels that this way money is saved and she knows exactly what she is getting. She feels the most important

criteria for selecting Bloodhounds are: easy care, minimal health problems, stubbornness, outgoing tendencies and curiosity. She feels stubbornness is important to keep a Bloodhound on the track. For this reason Bloodhounds operate off lead because the handler usually can contribute very little. Thus if the dog is not stubborn, he may get discouraged too easily. Mrs. Schroeder says the Bloodhound is plagued with multiple health problems such as a high tendency for abdominal torsion, and skin, ear and eye problems. She says the last thing she wants to worry about is continual treatment of a dog in the field. She also stated that Bloodhounds may take up to 5 years to mature and be ready for dedicated tracking. She related the working age to be about 8-10 years (Fact Sheet). She feels the Bloodhound cannot be beat as a tracker, but for search and rescue operations, especially when you may be looking for a dead body, other breeds such as the Labrador Retriever and German Shepherd are better because they are air-scenting rather than ground-scenting breeds. She concluded the interview by stating that she preferred food as the primary drive for training and work (Kay).Ω

Schwartz, Charlotte. Friend to Friend, Dogs That Help Mankind. New York: Howell Book House Inc., 1984. This book presents a detailed description of the diverse ways the dog serves man. The book is divided into 5 chapters: A Historical Perspective, Therapy Dogs, Service Dogs, Dogs in the Future, and Future Research Pathways. Each chapter contains many actual accounts of various programs that utilize the dog's numerous capabilities. Concerning detector dogs, the book quotes the price of 2,500 dollars to train a Narcotics or Explosives Detector Dog (p. 131,

Burwell). The book also discusses programs that utilize prisoners to train guide dogs, and the advantages for all concerned. The expertise and background of 2 of the contacts (Glen Johnson and Charles Caldwell) referenced in this thesis are also presented in this book. The author of this book concludes by offering some predictions of how the dog's role in the service of man might be expanded within the next 50 years. Some of the roles discussed include the following: Sign language for the deaf, espionage equipment detector dogs, water leak detector dogs, chemicals and precious metals dogs, finger print dogs, truffles dogs and alcoholic rehabilitation dogs. The final chapter addresses, primarily, the importance of the human/companion animal bond. An extensive directory of various dog associations is also provided, although numerous addresses and telephone numbers contacted by the author were not correct (Author's Note: This emphasizes the importance of having a system for keeping such information current).

Scott, J. P. "Critical Periods in the Development of Social Behavior in Puppies." Psychomatic Medicine, XX (1958): 42-54. This article reviews in detail the different phases of normal social development in the dog, which are based on changes relating to social relationships, anatomy, development of the 5 senses, heart rate, food motivation and frequency of feeding, finger sucking responses, and the exact onset of the different phases, both between littermates and between breeds, due to heritability. During the first 3 weeks of a puppy's life, it is very protected, due to maternal influence and lack of sensory development, from psychological influences. Scott identifies the existence of 5 critical periods in a pup's life. These 5 periods all occur before the

dog is 16 weeks old. Scott states that they are critical because after the first 16 weeks of life, a dog's ability to bond with humans and its learning capability of ability for behavior modification are greatly diminished. The length of time for each of the 5 critical periods are 0 to 21 days (basic requirements are food, warmth, sleep and maternal care), 21 to 28 days functional development of the brain and nervous system, emotional and social stress have their greatest impact at this time, presence of the mother is paramount (Wolfle), 28 to 49 days (begins to venture from mother to explore the world, begins to recognize people and respond to voices, litter social order begins to form, the puppies are ready to learn, weaning should occur during this time in order to have optimal influence on the pup's personality), 49 to 84 days (optimal time to establish the human-dog bond, the attachment made at this time will be permanent, as will the pup's attitude towards accepting training and man as being dominant; Fenton), and 84 to one 112 days (declaration of independence, proper development during the preceding phases will greatly affect how the pup survives the "teen" years to become a highly capable dog for training), respectively. Refer to Appendix E for graphics (Author's Note: The graph comes from Pfaffenberger's book Guide Dogs For the Blind: Their Selection, Development, and Training, p.21.).Ω

Scott, J. P. "Critical periods in Behavior Development." Science 138(1962): 949-958. Scott reviews the critical phases of behavioral development reported earlier, and then devotes the remainder of this article to specific factors or stimuli that influence the various phases. Some of the factors include punishment, separation, food, fear, conditioning versus imprinting, emotional arousal, maturation and other timing

mechanisms, and escape response. Scott concludes that to understand the process of socialization and its timing mechanisms for a particular species, one must study the development specific capacities entailed during the critical period, to include sensory, motor and learning. He further concludes that the social attachment probably continues throughout life, but occurs at a much slower pace outside of the critical period. Scott also reviews what is known about the critical periods that influence the process of learning. Here Scott presents a general hypothesis: "That the critical period for any specific sort of learning is that time when maximum capacities - sensory, motor, and motivational, as well as psychological ones - are first present." He also proposes that it is possible to "learn not to learn," and that negative mind set may be the stimulus that begins closure of the critical learning period. Q

Scott, J.P. Telephone interview, 11 December 1989. Dr. Scott comments that not much has been added to his work because of the lack of money and facilities. He said he was fortunate because he received a grant from the Rockefeller Foundation. The only current related work that he knows about is being done by Dr. Ginsburg. Dr. Scott mentions his experiences associated with Guide Dogs for the Blind. He said that in the beginning the washout rates were 50-60 per cent. They finally discovered the reason to be related to when the pups were scheduled to be sent out to the foster homes at 12 weeks of age. Some of them wound up just setting around in the kennel for an extra 4-5 weeks before being sent out. When they went back and compared the dog's performance to when the dog actually left for the foster home, they discovered that

those that sat around for 4-5 extra weeks were the worst performers when they returned and commenced formal training.

He referenced the information found in Guide Dogs, Their selection, Development and Training as being very informative. He stated that the evaluation tests described in the book were very effective in identifying the "real good ones and the real poor ones". He attributed the difficulty associated with picking the in-between dogs to be due to varied genetic development and expression.

To begin a breeding program he stated that it is very important to pick a suitable breed, and to realize that every breed has tremendous variability, and that no particular gene is responsible. He says it is a combination of emotional and motivational aspects. Pure intelligence is not the most important. He makes this statement to emphasize that at some point a guide dog must make a responsible decision and over ride a command of a blind person when the command, such as wanting to walk across a street in heavy traffic, is not in the best interest of the blind person. He states that the most undesirable trait is fear, and that for dogs raised in a kennel, this should be a major concern. To overcome this major potential obstacle would be very labor intensive. This is why a lot of the guide dog schools have foster home programs.

He thought the idea of using inmates to socialize the dogs had a lot of potential, and would also be good for the prisoners. He went on to mention that there is nothing sacred about withholding training until a dog is at least one year old. He said 9 months would be reasonable (Fenton). Concerning the feasibility of utilizing the technology of artificial insemination, Dr. Scott thought it would offer a wider variety

of genes because complex characteristics, such as behavior traits, are inherited via gene combination, and these combinations are broken up each time at fertilization (Leighton; Rankin, Letter).Ω

Scott, John P. and John L. Fuller. Genetics and the Social Behavior of the Dog. The University of Chicago Press: Chicago, 1965. This book is the classic in contributing to the understanding genetics and canine social behavior (Author's Note: refer to Voith Letter). The book reviews the complete evolution of the dog and is the compilation of all Scott's research.Ω

Sexton, Ted. Letter to CPT Denzil F. Frost, 8 December 1989. This letter contained information about the Alabama Canine Law Enforcement Officers Training Center, a Division of Shelton State Community College. Included was a curriculum description of different courses available for dog handlers, alone or to undergo training with a dog. European police training procedures are used and taught at the school. The school also offers a 9 week instructor's course, which entails 520 hours of instruction. Topics presented include Canine physiology (16 hours), breed selection (5 hours), police dog detection tests (16 hours), tracking and criminal evidence search (120 hours), obedience (40 hours), apprehension (120 hours), narcotics/explosives detection (120 hours), instruction experience (80 hours) and miscellaneous (8 hours).Ω

Sexton, Ted. Telephone interview, 11 December 1989. Mr. Sexton said that the Germans and the French are on the "cutting edge" of understanding the canine psyche and the development of more effective training techniques. He said they have identified certain drives that are very different psychologically when compared to humans. He says they have learned

that continual repetition does not guarantee success. The key is to be able to select specific drives for performance that parallel the genetic basis for those drives (Devaney). He stated that when his people go to Europe they look at 100-150 dogs before they find one that is acceptable (Caldwell, Reaver). Once they procure a dog only about 10 per cent will washout. He said the brokers sell all of the junk to the DOD buying team. He also said the MWD Program represented the state-of -the-art in working dog production during the 50's, but that times and techniques have changed.Ω

Shaw, Gary A. "The German Connection." K-9 Enforcer 4(4th ed. 1989):10.

This article describes the growing trend of importing dogs and training techniques from West Germany and France. A description of the Schutzhund title is included. This article also discusses both sides of the argument of importing these dogs and techniques. Opponents to the imports feel that the expense is prohibitive to smaller police departments, and a European title loses significance when the opportunity to import lower quality dogs exists. The author concludes that it is possible to have the best of both worlds. A Schutzhund title is not a guarantee of success unless it is coupled with an ethical and experienced importer.Ω

Shifflet, Kenneth W. Letter to CPT Denzil F. Frost, 5 December 1989. This letter contained a copy of FSTC-HT-1052-86, "Together With a Dog". This article was translated from Pravda. No other information was given.Ω

Shumilov, Pyotr. "Mine Detection and Clearance Party." Soviet Military Review (1987): 22, 23. This article is an account of a Soviet Mine

clearing operation in Afghanistan using platoons of dogs.

Sisley, Nick. "New Discoveries in the Realm of Scent." Gun Dog Magazine.

November/December 1997. This article describes the research being conducted at Auburn University by Larry Meyers, D.V.M., Ph.D. A review of the dog's olfactory capabilities is included along with a description of Dr. Meyer's research. A kit called SMETT is described that is designed for the dog owner to measure the olfactory capability of his/her dog. The kit sells for around \$14.50. This article shows the rate of technological improvement in the realm of olfaction, which in turn can assist in selection of dogs with superior olfactory capability, and help to understand the basic mechanisms of olfaction.

Slater, Robert O. Memorandum. 14 April 1987. Subject: International Drugs: Threat and Response. This memorandum reviews numerous techniques available for the detection of illicit drugs. They include point and remote laser sensors, application of taggants to drug plants growing in fields, immunoassays, the associated particle techniques, thermal neutron activation and real-time digital X-radiography.

Slavik, Don. Letter to CPT Denzil F. Frost, 2 January 1990. Mr Slavik recommends that I contact Peter Davola, whom Mr. Slavik has known since 1979 and says is a very capable canine handler, trainer and administrator.Ω

Slonaker, John F. Letter to CPT Denzil F. Frost, 17 October 1989. This letter contained a bibliographic guide to Institute sources, a working

bibliography on military dogs, and a brochure describing the Institute's holdings and services.Ω

Smith, Frances, O. "Update on Freezing Canine Semen". Current Veterinary Therapy IX "Small Animal Practice", Ed. Robert W. Kirk. W. B. Saunders, 1986: 1243-1248. This article provides an initial description of the state-of-the-art relating the artificial insemination, and a list of AKC-approved frozen semen facilities (Bowen, Concannon).

Smith, James C. Remote Detection of Explosives Using Trained Canines. International Symposium on Analysis and Detection of Explosives. March, 1983. Forensic Science Research and Training Center, Federal Bureau of Investigation Academy, Quantico, Virginia. This article discusses a search method which combines accuracy (high probability of detection), speed of search (< 10 seconds), and cost. The objective of the system proposed is to prevent sabotage. Further discussion centers on the potential capabilities and limitations of dogs to conduct personal searches, and how to set up a training regimen for the dogs.

Soderberg, Susan F. "Canine Breeding Management." Reproduction and Periparturient Care. The Veterinary Clinics of North America - Small Animal Practice. Cheri A. Johnson, Guest ed. 16 May 1986. This article reviews prebreeding examinations for both sexes and states that breeding should occur every 2 to 4 days during estrus in order to obtain optimal rates of conception. Semen collection, evaluation, and artificial insemination are also discussed.

Stamp, Gary L., LTC. Letter to CPT Denzil F. Frost, 24 January 1990. This letter was in response to a request from the author to share his interpretation of DOD Directive 5200.31 which establishes a single

manager for the MWD Program. LTC Stamp states that the DODDC does not have any official input into management, although it is responsible for procurement, supply and distribution of all MWDs. The training branch also has no official input. This is also true for the U.S. Army Veterinary Corps. Appendix F is LTC Stamp's interpretation, in the form of a wire diagram, of the command and control of the MWD Program, in reference to DOD Directive 5200.31. LTC Stamp also stated that a proposal for a new organization has been submitted which should include the Veterinary Corps in management decisions.Ω

Stamp, Gary, LTC. Telephone interview, 1 December 1989. LTC Stamp discussed the DOD Directive 5200.31, and described the command and control of the MWD Program. He acknowledged that it is quite confusing, and offered to send a wire diagram representing his interpretation (Andersen, Appendix F).Ω

Starodymov, N. "Keep the Column Moving." Voyennyy Vestnik (October 1986): 66-68. This article relates the personal experiences of the author on mine clearing operations in Afghanistan. He make numerous references to the slowness of the obstacle-clearing engineer vehicles. He also describes the methods employed using dogs to accomplish the same tasks.

Stauffer, Alvin P. "The War Dog Program." Historical Section, General Administrative Services Division, Office of the Quartermaster General. This paper provides a great deal of information about the use, organization and training of dogs during the 2 world wars.

Strobel, Richard. Letter to CPT Denzil F. Frost, 9 February 1990. This letter contained a copy of the Canine Accelerant Detection Training Seminar, 23, 24, August 1988. See Noll for a description of the seminar.Ω

Sukhomlin, I. "Working Dogs in the War." Voenno Istoricheski Zhurnal 8 (1971): 93-98. This article was translated by MAJ Gephart (SASO, Ft. Leavenworth, KS. This article discusses the use of dogs against the Germans in World War II. Particular detail is provided about the Russian use of dogs to destroy the German Panzer tanks. The author states that the dogs were most successful when the Germans were attacking. The reasons attributed to this success was because they were trained to key in on moving tanks and the sounds of the tank motors. He also describes the methods of how the dogs were deployed. The article cites details of specific battles and the losses to the German units.

Sullivan, Regina M. and Michael Leon. "Early Olfactory Learning Indices on Enhanced Olfactory Bulb Response in Young Rats." Developmental Brain Research. 27(1986): 278-282. This study demonstrates that olfactory sensitivity in rats can be enhanced postnatally between 1 to 18 days (Author's Note: Perhaps the same thing could be shown in the dog).

Sundgren, Per-Erik. Letter to CPT Denzil F. Frost, 14 February 1990. Dr. Sundgren begins his letter by apologizing for the paucity of information available in English about the Swedish Dog Breeding Center. Dr. Sundgren states that the Swedish Dog Training Center was formerly called the Army Dog Training Center of Sweden, and that during the "technical era of the 70ths" the Swedish Army almost entirely stopped working with dogs. He attributes the resurgence in the interest of working dogs to drugs and the demand by blind people for guide dogs.

He says that the German Shepherd is used primarily for detection and patrol work, while the Labrador Retriever is preferred for guide dog work. Dr. Sundgren discusses their discoveries of heritability for hip dysplasia, which they reported to be around 0.4 - 0.5 in the 70's. He says they were unable to make any significant progress in lowering this heritability because they did not have a selection differential. Ten years later he says they have now brought the incidence of hip dysplasia in Alsatians down to about 0.1. This was achieved via a simple scheme using only animals that were classified free from hip dysplasia, with an absence in the parents also, and a maximum of only 1 litter mate showing signs of hip dysplasia.

For the past 3 years, Dr. Sundgren has been reorganizing the training program by placing all of the training data on computers. The primary objective of this effort will be to 1) evaluate dog behavior retrospectively and 2) to produce new testing methods that will be as free of subjective judgements as is possible. The evaluation of behavior will be done by weighing the scores of behavior which is dependent on the relative frequency of the type of behavior scored at acceptance and after completing training. Dr. Sundgren says that to him retrospective scores seem to make some sense since they have found moderately high heritabilities for such scores. He also said that the direct testing scores never attained the same levels. Currently, the Center maintains 50 bitches. To meet their needs, Dr. Sundgren figures they will need about 70 bitches and 12-15 studs to produce a herd of an effective population size of 100 pups. The Center presently produces 400 puppies

per year, of which about 100 will complete training (Adams, Goddard Letter, Rankin).

Currently, the Swedish Army maintains about 2,000 MWDs. Dr. Sundgren predicts that number to increase to around 8,000. He also concludes that the Center will not be able to handle that number of dogs, let alone the numbers required to produce a working population of 8,000! He says they are planning some form of a network system that will include private breeders, because according to his calculations they will need over 300 bitches, and "without any breeding efforts we will need 600 bitches." He concludes his letter by expressing a willingness to communicate and conduct future discussions about their progress.Ω

Sundgren, Per-Erik, "The Imprinting of Behavior and It's Importance in the Selection and Breeding of Dogs For New Tasks." This article was included in the letter from Dr. Sundgren. The article does not indicate the source nor the date of publication. This paper discusses and provides evidence that behavioral traits express genetic variation, and that with the new scoring systems developed by Dr. Sundgren indicate heritabilities between 0.15 -0.50 for specific mental testing scores. The effects of population size on genetic drift and its consequences are also discussed.

The paper defines the coefficient of heritability as that proportion of the difference between animals in a certain trait that can be explained by heredity, and that the most simple and reliable way to determine this value is to compare the average values of progeny groups to the corresponding values of their parents. Dr. Sundgren states that until the results of this study, he felt quite sure about the strong imprinting

(socialization) influence of the bitch on the pups. But now concludes "that the pup's behavior is moderately influenced by hereditary factors and that there might be influences by common litter environment." He concludes that socialization is a delicate process that requires a firm understanding of how to breed and raise dogs.

The paper also provides data to indicate that selective breeding will efficiently separate dogs into strains with differences in behavior. The following character traits were studied in the paper: courage, aggressiveness, will to defend, fighting spirit, mental balance, activity, intrepidity, will to cooperate, and approachability (Author's Note: See Goddard Letter).

Based on a factor analysis, Sundgren concludes that there are 5 distinct groups of dog behavior. They are: 1) The will to make contact with humans. 2) Fearful behavior, of which there are 2: fear of living creatures and fear of unidentified objects and/or sounds. The author of the article also mentions that fear of odor could probably be included here, but that it was not tested. 3) Interest in moving objects. 4) Explorative behavior, often masked by fear because fearful dogs will not show curiosity. 5) Will to play and fight. Dr. Sundgren emphasizes that the formulation of any effective testing procedure must account for these 5 groups of behavior, and that the tests should describe rather than evaluate behavior. "Because," he says, "We do not want all of our breeds to become alike." With respect to genetic diversity being the base for progress through breeding, the paper gives the following rule of thumb: a population should not be larger than 4 times its number of breeding males. He further recommends that in order to avoid uncontrollable

losses due to genetic variation, one should maintain an effective population size of around 120-240 individuals, and that the number of active stud dogs should remain above 20-30. The paper states that a maximum of 50 would be required in order to allow genetic progress to increase substantially.

With respect to imprinting and breeding for behavior, Dr. Sundgren agrees with Scott and Fuller, and Pfaffenberger in that the efficiency of selective breeding will be greatly minimized without proper socialization of the pups. He also stated that overambitious puppy training may be over stimulating and lead to permanent behavior problems in adult dogs (Fenton, Kay).

During a question and answer session that is contained within the paper, Dr. Sundgren responded to a question about the use of artificial insemination (AI) by stating that it is both dangerous and necessary. AI can be dangerous because of the temptation to intensively use famous stud dogs via AI (Leighton, Rankin). On the other hand, AI is very beneficial in allowing for the breeding of small numbers of dogs in exchange for a broader spectrum of genetic variation.

The paper concludes with the following general conclusions:

1. There can be no doubt about the heritability of a number of behavioral patterns in dogs.
2. Suspension of selection for behavior will cause deterioration of behavioral patterns.
3. Breeding in small populations will produce random genetic effects in all traits, including behavior.

4. Breed characteristics in the behavior of dogs are mainly the effects of planned breeding for specialized tasks.
5. Desired behavioral patterns can only be maintained over long periods of time through planned breeding.
6. Breeding plans have to be developed, and put into practice, to avoid deterioration of mental and physical capabilities of all dog breeds.
7. Better understanding of the mental development of pups, especially imprinting processes, will enhance the possibilities to improve behavior by systematic breeding.Ω

Suvorov, Viktor. Spetsnaz, The Inside Story of the Soviet Special Forces

New York: W-W Norton & Company, 1987. This book gives special mention of the Soviet use of dogs in the Spetsnaz, pages 102-105.

Suvorov states that the greatest fear of a Spetsnaz soldier is, and will always be, the enemy's dogs. This is because they themselves use dogs so well and thus know the capabilities of a well trained dog to detect or impede enemy activity.

Symthe, R. H. The Mind of A Dog. Springfield, Illinois: Charles C.Thomas, 1961. Largely anecdotal in content, the book discusses the relationship between dog and man, factors that influence dog behavior, such as food companionship, sex, avoidance of enemies, exercise, and play. Symthe also presents a hypothesis that the puppies with the best smell are able to locate the nipple the easiest.

Syrotuck, William G. Scent and the Scenting Dog. Rome: Arner Publications, Inc., 1972. This book was brought to the attention of the author by Sergeant Jeff Fenton of the Phoenix City Police Department (Fenton telephone interview). The author of the book states that the purpose of

the book is to bring together new information in the literature and correlate the pertinent facts of these theories and their interpretation in reference to what is known about the dog's ability to detect and discriminate between human beings. The book contains a lot of practical information about what to consider when handling a dog that is on a track. The following is a list of the chapter headings: 1) The Sense of Smell, 2) Anatomy and Physiology, 3) Theories of Odor, 4) The Human Scent as a Scent Source, 5) Transmission, 6) Atmospheric Factors and Airborne Scent, 7) The Ground Scent Picture, 8) Analysis of the Scent Picture, 9) Working Dogs on Scent, 10) Snow, 11) Experiments, and 12) Questions and Answers (Ashton, Fenton, Mueller, L.).

Taylor, Bill. Letter to CPT Denzil F. Frost, 16 August 1989. Information contained in this letter pertains to descriptions of how dogs are evaluated for their potential to be Patrol/Detector Dogs. Mr. Taylor stated that patrol dogs are purchased in 3 categories, untrained, partially trained and fully trained. Definitions for each category can be found in Chapter I. Mr. Taylor referenced 3 testing procedures that are used by the DODDC to evaluate potential detector dogs. They are: 1) Rubber ball evaluation. This procedure measures how aggressively a dog chases, searches and plays with the ball (with or without handler assistance). The dog is also evaluated on how well he attends to the ball regardless of surroundings or circumstances. Ideally, the dog should not voluntarily drop the ball. 2) Squeaky toy evaluation. This procedure is designed to get the dog's attention by squeaking the toy and throwing it up into the air. The dog is evaluated on ball-attentiveness and how aggressively the dog searches for the toy when it is hidden. Ideally,

once the toy is found, the dog should hold the toy in its mouth for at least one minute, regardless of the distractions. 3) Food evaluation. The dog's attention is gained by rattling the metal food container while removing the food (Kay). Once the observer sees that the dog is familiar with the sound of the container, the food is hidden. Once the food is found the dog is allowed to eat it. As the evaluator hides the food, he taps the side of the can. An acceptable dog is expected to locate the food with or without handler assistance. Temperament evaluation guidelines were also included with the letter. These guidelines describe different forms of aggression, submission, dominance, and play-soliciting behaviors, and then describe acceptable actions or mannerisms.Ω

Taylor, Earl V., Lt Colonel. Letter to CPT Denzil F. Frost, 22 March 1990.

This letter was sent upon request by the author for figures of production and associated costs for each type of dog produced by DODDC. Also included, as attachments, were the procedures for certification of Patrol, Explosive and Drug Dogs, and training protocols for the Patrol and Drug Dogs. Total costs for certification (total number certified) and the rate of rejection for the Patrol Dog, Patrol/Drug Dog, Drug Dog and Patrol/Explosives Dog were provided in the form of 5 year weighted averages. They are 6,772 dollars (1865) 21 per cent; 9,050 dollars (356), 29 per cent; not provided (33), 33 per cent; and 11,054 dollars (360), 43 per cent, respectively (Burwell). Certification for all MWD specialties is the responsibility of the Animal Behavior Section, as is recertification. Certification as an Explosive Detector Dog requires a 95 per cent detection rate with no more than 2 false positive identifications by the dog. A level of 90 per cent is required for Drug

Detector Dog certification. The training protocol for Drug Detector Dogs states that it usually requires 12 weeks to attain a 90-95 per cent proficiency level of detection. This protocol also states that during training the dogs are tested after they are held off food for 24 hours in order to determine if they will work for food. The sequence of training tasks is also stated to not be important for this type of training. Q

Thal, R., C. Thal and R.E. Lubow. "Mine Detector Dogs." DTIC AD 874794L.

This report is included here because it relates some of the problems the investigators had with procuring dogs from breeders. The primary reasons for rejection center around behavioral and or medical problems. The behavioral problems related to either over-aggressiveness or timidity. The investigators felt these problems were the result of improper socialization. The medical problems for rejections were only identified as defects.

The Commission of Peace Officer Standards and Training. State of California. "Law Enforcement Service Dog Programs." April 1985. This document is the result of the observation by police K-9 handlers and trainers that little has been written about implementation, organization, or maintenance of K-9 units, even though these units have been an integral part of the California police force for over 40 years. This document focuses program implementation, unit organization, handler/dog selection liability and equipment. This document states that the breed of dog is not as important as the temperament and trainability (page 5). Concerning temperament evaluation, the Swedish test is recommended due to its ability to recognize mental characteristics that are very desirable in service dogs. The text mentions courage,

aggression, confidence, hunting instinct, drive, and olfactory ability as those traits highly indicative of trainability. Interpretation of the Swedish test results are very dependent on an understanding of the psychological composition of a dog (Sundgren).

The White House. National Drug Control Strategy, January 1990. This document discusses the current laws and official policies implemented combat the nation-wide drug problem, and delineates the military's role as one of support only.

Thomas, R. E. (CPT). "Selecting the Modern War Dog." Journal of the American Veterinary Medical Association. 127(1955): 206. This article discusses various breeds of dogs considered for use in the military, and explains why the German Shepherd is the preferred breed (Jennings, K-9 Plus, McIntire).

Thorton, William H., LTC. The Role of Military Working Dogs in Low Intensity Conflict." Army-Air Force Center for Low Intensity Conflict. This paper discusses the historical and current roles of the MWD, and presents reasoning for the need to expand the role of the MWD. Such reasoning centers around economy of force, low technology, high capability, operational flexibility of the MWD, and the need for wider use of the MWDs capabilities other than as a law enforcement asset. Problems with the current MWD system are presented. The paper states that 98 per cent of all dogs procured by DODDC come from Europe, that 45 per cent are rejected after training, and that there is a backlog of 430 requisitions of MWDs (Taylor, E.). The report concludes that the Dog Training Center lacks the resources to provide trained dogs to meet all of the requirements of the Using Agencies. The author of the article

strengthens his claims by citing 3 conclusions of the Council of Colonels meeting in May 1989 (U.S. Army, Combined Arms Center) that were: 1) The MWD Program is broken and cannot meet existing requirements. 2) DOD executive agent has not acknowledged a need for MWDs to perform functions outside law enforcement and security missions. 3) Support of LIC operations is the most urgent requirement and an area in which the appropriate MWD involvement can contribute immediately. A comparison to the British Army MWD Program is presented and states that the British receive all of their dogs by donation through community relations and effective advertisement (Durrant, Nixon). The Royal Veterinary Corps is in charge of procurement, training and maintenance of the working dogs, and the dogs are trained for single use roles only. The remainder of the paper is devoted to proposed expanded roles of the MWD, such as Mine/Booby Trap Detection Dog, Scout Dog, Tracker Dog, and Search and Rescue Dog.Ω

Tomlinson, Samuel J. Letter to CPT Denzil F. Frost, 16 December 1989. Mr. Tomlinson recites the research that has been done over the years at Southwest Research Institute (SWRI) relating to olfactory/sight/hearing work. He referenced various projects conducted for the U.S. Army (MERC) on trying to determine the olfactory detection capabilities of such species as pigs, foxes, wolves, peccaries, coutimundi, and ferrets. He also thought this same group tried some parent-offspring olfaction training with pups following the parents, which would be similar to a feral animal training her young in hunting for food (Ohrn, "When it Comes to Hunting..."). Mr. Tomlinson stated that in all the research he has read about or has conducted, the dog was always able to discriminate better

than a machine. With the development of micro sampling and laser conductance monitors, he feels we could get a better handle on the dog's threshold levels. He stated that would be very interesting work, and that SWRI has the research capability. Mr. Tornlinson concluded by saying SWRI would more than likely be willing to help if a feasibility study could be funded. He then listed several ways SWRI could assist the MWD Program, such as determine canine olfaction thresholds, evaluate how much behavior is involved with olfaction, determine the most reliable source of dogs for the military, establish a data base of good candidate pups from qualified parents throughout the U.S. He estimated a requirement of 500 to 700 replacement dogs per year to meet current demand (Burwell).Ω

Turbiville, Graham H. "Soviet Combat Engineers in Afghanistan." The Military Engineer (September-October 1988): 560-565. This article contains photographs of dogs being used at the point on mine clearing operations and accompanying a mine-clearing sapper team on a tank. Turbiville describes the challenges facing the use of dogs in Afghanistan, to include weather, fatigue from long patrols and the problems of gasoline fumes compromising the dogs' olfactory capabilities. He also mentioned that the Soviet breed of choice is the German Shepherd.Ω

U.S Army. FM 7-40, Scout Dog Training and Employment. Washington, D.C.: Headquarters, Department of the Army, 1 March 1973. The sequential chapter layout for this manual is as follows: Introduction, Scout Dog Team Training, The Food Reward Method, Basic Scouting, Intermediate Scouting, Specialized Training, Advanced Scouting, and Employment.

U.S. Army. AR 11-28, Economic Analysis and Program Evaluation For Resource Management. Washington, D.C.: Headquarters, Department of the Army, 2 December 1975. This regulation was developed to assist in decision making situations that require choices between alternative solutions(strategies). AR 11-28 lists the following as minimum-essential elements of an economic analysis: objectives, assumptions and constraints, alternatives, benefits (outputs), cost estimates, and cost analysis. This reference is included here because of the guidelines listed on how to determine the cost benefits associated with fielding a military system, in this case the MWD.

U.S. Army. FM 7-41, Mine and Tunnel Dog Training and Employment.

Washington, D.C.: Headquarter, Department of the Army, 2 March 1973. The sequential chapter layout for this manual is as follows: General, The Food Reward Method, Basic Detection Training, Intermediate Detection Training, Advance Detection Training, and Employment.

U.S. Army. FM 7-42, Combat Tracker and Tracker Dog Training and Employment. Washington, D.C.: Headquarters, Department of the Army, 2 March 1973. The sequential chapter layout for this manual is as follows: Introduction, Introduction to Tracking, Tracking signs, The Track Following Drill, Tracker Scout, Tracker Recondo Patrol, Silent Signals, Combat Reaction Drills, Reading the Track, Deception Tactics, Finding a Lost Track, Tracker Dog Training, Combat Tracker Teams, and Visual Tracking Course.

U.S. Army. FM 19-35, Military Police Working Dogs. Washington, D.C.: Headquarters, Department of the Army, 18 February 1977. The sequential

chapter layout for this manual is as follows: Introduction, Patrol Dogs, Sentry Dogs, Narcotics Dogs, and In-service Evaluation Procedures.

U.S. Army. FM 20-20, Military Dog Training and Employment. Washington, D.C.: Headquarters, Department of the Army, 1 May 1967. This manual is now obsolete, but contains a lot of information on the general maintenance of the MWD skills. The manual also contains many diagrams and photos depicting certain tasks and methods of use and training.

U.S. Army. Systems Acquisition Policy and Procedures. Washington, D.C.: Headquarters, Department of the Army, 10 October 1988. This regulation describes the Integrated Life Cycle System Management Model (LCSMM). The purpose of the LCSMM is to provide structure and control throughout the system's life cycle. LCSMM is a combination of activities, documentation and events/decision points within a basic framework of life cycle phases. The primary events and phases are listed below:

- 1) Program initiation
- 2) Concept exploration
- 3) Demonstration and validation
- 4) Full-scale development
- 5) Production and deployment
- 6) Operation and support

This reference is included here because it provides guidance on the fielding of new military systems within the Army, and it is the author's opinion that any considerations for expanded use of the MWD, or altering the current MWD Program would benefit from the guidelines found in this regulation.

Urena, Patricia Letter to CPT Denzil F. Frost, 13 December 1989. This letter contained the legislation for the White Cane Law and the Business and Professions Code for Guide Dogs for the Blind. Ms. Urena stated that the State of California is the only state that has legislation regulating the training of guide dogs, and sets standards for certification.Ω

Urena, Patricia. Letter to CPT Denzil F. Frost, 19 December 1989. This letter contained copies of Business and Professions Code Section 7218, which describes the certification process for guide dog handlers and training facilities. Included also was a list of the 3 licensed guide dog schools in the state of California. Ms. Urena also mentioned that the California Legislature is considering licensure of signal and service dog providers.Ω

Ustinov, G. "Service Place-Afghanistan: Courageous Men." Izvestiya (27 July 1985): 3-6. Mr. Ustinov is a war correspondent who describes in this article the mine clearing operation to break the encirclement of Barikot, which is located in the Kunar province. The author describes how the Soviets clear 28 kilometers of mountain road that had an estimated 9 to 14 mines per square meter. He reports that half of the mine clearing operation occurred at night. Dog/handler teams were at the point at all times. Ustinov interviews one team by the name of Aleksandr Nikitin and his dog Aza, who is a sheep dog. They found 21 mines during the operation. The record for the operation went to El'za and Inga, who found over 100 mines. Aleksandr received Aza as a puppy and trained the dog himself to detect explosives by placing meat on explosive samples. The difficulty of detection graduated from meat on an explosive sample to meat placed on a hidden and camouflaged sample.

At the age of 2 months Aza learned how to walk in a zigzag fashion (Fenton). The article reports that at the age of 8 months, Aza was ready for field work. Nikitin praised his dog for self-discipline and seriousness during exercises. Nikitin is quoted in the article as saying that Alsatians are the best for searching, and that they prefer females because the males battle endlessly for dominance (Durrant, Nixon). The article brings out some pertinent distinctions between exercises and a real operation by stating that due to long periods of travel in an armored personnel carrier a dog's senses can be compromised by noise, road dust and gasoline fumes. Sufficient rest is then required before the dog can perform as expected. Special conditioning to the heat is also mentioned as a critical requirement to successful mission completion.

Varner, John G and Jeannette Johnson Varner. Dogs of Conquest. Norman: Oklahoma University Press, 1983. This book relates the role of the dog in the conquest of the Americas, as described in the journals of the Spanish Conquistadores, to include Columbus.

Veterinary Clinics of North America, Small Animal Practice. Reproduction and Periparturient Care. Cheri A Johnson, Guest ed. New York: W.B. Saunders Company, May, 1986. This compilation of articles presents information relating to breeding management, pregnancy and parturition, disorders of pregnancy, surgical and anesthetic techniques, postpartum diseases, drug therapy during pregnancy and in the neonate, common disorders in canine reproduction, and genetic anomalies affecting reproduction and periparturient care.

Vladimirov, Sergei. "An Unusual School." The source could not be determined. A photocopy of the article was obtained from Dr. Graham H.

Turbiville. This is a brief response from a comrade in Syria who wanted to know for what purpose Soviet Armed Forces uses dogs, and when they were organized. The article states that the first use of dogs in mass occurred in Germany in 1884, which later spread to Austria-Hungary, Italy, Russia and France. According to the article military breeding of dogs began on 23 August 1924. The article then recounts examples of the service rendered by dogs in the Great Patriotic War. The article discusses the activities of the instructors of the school and the training of the handlers. The article lists the following breeds of dogs as being preferred by the Soviet Military: Airedale Terriers, and Russian, German and Caucasian Shepherds.

Vodyanoy V. and Igor Vodyanoy. "ATP and GTP are essential for Olfactory Response." Neuroscience Letters, 73 (1987): 253-258. Describes the progress in basic olfactory research. Confirms the existence of 3' 5' monophosphate (cAMP) as a second messenger in the beginning steps of olfactory transduction.

Voith, Victoria L and Peter L. Borchelt. "Separation Anxiety in Dogs." The Compendium on Continuing Education 7 (1985): 42-53. This paper presents a common behavior problem in dogs, in terms of etiology, diagnosis, and treatment.Ω

Voith, Victoria, L. Letter to CPT Denzil F. Frost, 31 August 1989. Dr. Voith states that the most extensive work done on development of social behavior in dogs and the critical periods is still the work of Scott and Fuller.

Voith, Victoria. "Applied Animal Behavior for the Veterinary Practitioner." 47th Annual Meeting Proceedings of the American Animal Hospital

Association, 0610 Animal Behavior, 1980. This article gives a general overview of what animal behavior is, how information is gathered and how animals learn, describes the many variables that affect learning, and the classification problems stemming from abnormal behavior and their etiologies.Ω

Walbert, Calvin. Telephone interview, 23 February 1990. Mr. Walbert stated that the Federal Aviation Administration (FAA) started using dual-purpose dogs back in 1971, with the primary intent of convincing state and local police departments of the utility of a dual-purpose working dog (Felt; Kay; McEathron; Mueller, Lance; Noll). Prior to that time most police departments did not have enough drug or explosive work to keep a dog operating sufficiently to justify the purchase. Mr. Walbert went on to say, however, that in October of 1989 the FAA decided to go back to the single-purpose working dog for the following reasons: 1) Dual-purpose dogs were in short supply and it took too long to obtain one from the DODDC. 2) The FAA really did not have any missions that required dual-purpose dogs. 3) Due to increased public awareness, the FAA decided to avoid the use of German Shepherds because of the public image associated with these dogs and the racial riots of the 60's, and their use in the Vietnam War (Dennis). For these reasons, Walbert said the FAA now prefers Labrador Retrievers because they are better explosive and drug detectors. When asked if the FAA had considered alternative sources for dogs he said they had but they could not find anything comparable to the finished product coming out of the DODDC. He said the FAA was very pleased with their relationship with the DODDC.Ω

Waldrop, M. Mitchell. "FAA Fights Back on Plastic Explosives." Science, 243 (1989): 165, 166. This article discusses the development of new explosives and the significant impact they are having in the war against terrorism. The article reviews the Pan AM Flight 103 explosion over Lockerbie, Scotland and the challenge for the airlines to ensure safe travel of their passengers. According to the article, the most current and accessible form of technology available involves thermal neutron activation. The rest of the article describes the development and implementation of the system by Science Applications International Corporation, which is under contract with the Federal Aviation Administration. The article states that the system is capable of detecting 1 part of explosive in 100 trillion. The same company is also developing hand-held explosive scanners, and is also developing cocaine and heroine detectors. The article concludes with one obvious downside to this new technology, more expensive airline tickets.

Walter, Anna M. Dogs and the National Defense. Office of the Quartermaster General (1943). This study describes the development of the MWD program in the U.S., to include the perspective of the decision-making options relating to the MWD Program as the nation went through times of peace and war.

Walther, Kathleen. Letter to CPT Denzil F. Frost, 2 October 1989. Ms. Walther states in her letter that the Humane Society of Bexar County euthanized approximately 2,300 dogs in 1988 (Lammers).Ω

Wanner, Philip H. "Service Dogs." The German Shepherd Dog Review, (1965): 31-35. This article reviews the use of dogs throughout the history of war.

Ward, James. Telephone interview, 20 December 1989. When asked to explain why we were buying dogs in Europe, Mr. Ward responded that there were not enough dogs in the U.S. In addition, American dogs were not familiar with the ball technique used in the evaluation procedure. He also said a buying team would spend 2-3 weeks in different regions of the U.S. and would only return with 100-150 dogs, and the expense just did not justify the number of dogs bought. When asked to explain the virtues of the Belgian Malinois, Mr. Ward stated that this dog was a quick learner, could be trained faster, had a good nose, and "could be turned on and off a lot faster than a German Shepherd." Mr. Ward said he would send a cassette tape describing the European MWD buying operation.Ω

Warwick, Everette James and James Edward Legates. Breeding and Improvement of Farm Animals. New York: McGraw-Hill Book Company, 1979. Although minimal information concerning dog breeding programs is contained in this book, it provides a great detail of information about the different genetic methods used to improve animal breeds.

Watson, Milton J. Letter to CPT Denzil F. Frost, 23 March 1990. Mr. Watson states that the biggest problem most police units have in finding good dogs is the absence of a single source from which to procure dogs. Most units do not have enough money to send someone all over the country to find the best dogs. He says that most police departments prefer a pure-bred German Shepherd. Mr. Watson concluded the letter by providing the names and addresses of 4 master trainers who also import dogs from around the world.Ω

Wells, Dean. Letter to CPT Denzil F. Frost, 8 April 1990. SGT. Wells describes the Vancouver Police Dog Squad, that began operation in 1957.

He states that in addition to their law enforcement duties, they maintain a heavy schedule of community relations appearances. They only use intact, male German Shepherds (Durrant, Jepson). Procurement is by donation only. Those who donate their dogs receive a tax benefit. He also mentions a puppy donation program that they have just recently started, and SGT. Wells feels that it is quite successful. Once the pups are received they stay in the handler's home until they are ready for training at 12 to 18 months of age. During this time the pup is evaluated for its true nature, health, the intensity of the fetch drive (Parks), and how the pup handles unusual situations. He references his preference for the "1 dog, 1 man" theory of training and bonding (Dennis, Kay). Training classes are kept small and minimum levels of performance are clearly understood by all trainers. He concludes by expressing a willingness to share information and to provide contacts with The Royal Canadian Mounted Police and several other governmental agencies that use dogs for detection of food, drugs, and explosives. Q

Weidel, Michael. "Admissibility of Bloodhound Evidence." Law and Order

November 1979: 30, 31, 50, 51. Mr. Weidel is an attorney who describes in this article what is required for evidence obtained from using dogs to be admissible in a court of law. Mr. Weidel states that the first step is to establish the Bloodhound handler as a qualified expert. The handler must then give testimony relative to the dog he used in a particular case, and the facts associated with that case. The facts must include the following: 1) That the Bloodhound is a pure blood of the breed that is characterized by a keen olfactory capability. 2) That the Bloodhound has been trained to follow the scent of humans. 3) That the particular

Bloodhound has a proven track record and has been found to be reliable in pursuing a human track. 4) That the Bloodhound was placed on the track in the location where the alleged participant(s) of a crime are known to have been. 5) That the Bloodhound was placed in this vicinity within a period of time that represents his efficiency and capability. Mr. Weidel concludes by suggesting that anyone who has questions about rules and procedures pertaining to the admissibility of evidence obtained from Bloodhounds should contact the National Police Bloodhound Association.Ω

Whitstock, Robert H. Letter to CPT Denzil F. Frost, 26 October 1989. Mr.

Whitstock mentions in his letter that they were very appreciative of the dogs received from the biosensor program. He states that all of those dogs are now deceased, and that there may be some remnant genes in the current gene pool, but it would be very unlikely. Currently the Seeing Eye, Inc. has 44 studs that produce 344 puppies last year. Once the puppies reach 8 weeks of age, they are placed in special foster homes. At present they have 299 puppies in these homes. At any one time there are 160-180 dogs at the center undergoing training to become guide dogs for the blind.Ω

Wimer, R. E. and C. C. Wimer. "Animal Behavior Genetics: A Search for the Biological Foundations of Behavior." Annual Review of Psychology 36 (1985): 171-218. The objective of this paper is to present an integrated review of contemporary animal behavior genetics, due to the great diversity of interests of animal behavior geneticists working on the myriad of topics involved in behavior genetics. The conclusion of the review was that the resolution between the roles genes play in the expression of behavior increases in clarity as research continues.

Wohltjen, Hank, David S. Ballantine, Jr. and N. L. Jarvis. Vapor Detection With Surface Acoustic Wave Microsensors. American Chemical Society Symposium Series No. 403. Chemical Sensors and Microinstrumentation. Royce W. Murray, Raymond E. Dossy, William R. Heineman, Jiri W. Janata and W. Rudolf Seitz, eds, 1989. This paper reviews the current capabilities and progress of surface acoustic wave sensors toward practical use. Factors affecting temperature and coating selection are discussed (Jarvis).

Wolfle, Thomas L. "Policy, Program and People: The Three P's to Well-being." Canine Research Environment, Conference of Scientists Center. 22 June 1989. Ed. Joy A. Mench and Lee Krulisch. Bethesda: 41-47. Dr. Wolfle emphasizes in his article the importance of the socialization of dogs raised in a kennel setting being centered around policy, program and people: the 3 P's to well-being in a kennel operation. He states that it is very important to set goals and priorities in setting up any operation, and that a one-on-one relationship between each puppy and a person 5 minutes per-pup per-week and twice-weekly interactions between litters can firmly establish the socialization patterns required for a normal life. The program he recommends evolves through 4 steps that are listed as follows: Step 1: Beginning between 4-6 weeks of age and continuing until 6-8 weeks. During this time a technician enters the kennel, sits quietly, offers food, but does not pick up or restrain the pups. Wolfle feels that this is the most important step because sitting leaves a human scent that can be explored by the pups after the person leaves. These sessions last 15-20 minutes and are repeated twice per week. Step 2: Beginning 6-8 weeks and continuing for 1 week. In

addition to the actions described in Step 1, a collar is placed on the pup. On the next visit the collar is checked for proper fit. Step 3: Beginning at 8-9 weeks and continuing for variable duration, depending on the time available at each session. All previous steps are observed, in addition to a leash being attached to the collar and fastened to the kennel door. Step 4: From 9 Weeks on. Pups begin to be led by the leash, first around the kennel and then to different areas within the facility. During this time they are also taught to stand on metal tables, wobbly scales, walk on slick floors, grass and gravel. Wolfe states that the goal of this phase is to teach self-confidence and to develop the ability to adapt to new situations. Dr. Wolfe then describes the rating of each puppy on a 3-variable socialization scale of 1 to 5, with 5 being the best performance. The 3 variables are kennel greeting, on leash and table behavior. He comments that, with very few exceptions, animals that ranked high in kennel greeting remained very social and easy to handle throughout life, and that variable 3 was the least predictive of the 3. He also mentions that an animal that receives all 5's is too socialized to people to be a good breeder or become a good parent, and that all 1's are not suitable for research or breeding. Those that get all 1's will generally get along with other dogs, breed well, and nurse their young, when people are not around. Wolfe also states that the optimum time to start the socialization process is at 6 weeks of age, and that for socialization to be of any benefit for the rest of the dog's life it must be started before the pup is 16 weeks old (Appendix E, Pfaffenberger, Scott-Psychomatic Medicine).Ω

Wright, R.H. The Science of Smell. New York: Basic Books, 1964. This book examines the molecular theories of olfaction in easy, general terms. Wright contrasts olfaction of insects to that of higher animals such as the dog and man. He also mentions the importance of vitamin A in olfaction. He cites a case study where 56 people who could not smell, even though the olfactory apparatus was intact in each case. Each person received a large dose (exact amount not reported) of vitamin A intramuscularly and 50 of the patients experienced partial or full recovery of their olfactory capabilities.

Wyler Jan. Letter to CPT Denzil F. Frost, 23 February, 1990. This letter provides information about the American Embryo Transfer Association, and the Society for Theriogenology, and various manuals, newsletters and videotapes that describe different procedures concerning animal reproduction. Due to the lack of economic incentives Ms. Wyler said very little emphasis is directed toward small animal reproduction, although the capability and technology does exist within these organizations.Ω

Wysocki, Charles J. "Information Transfer Via Chemical Senses - Form and Function." This report reviews the anatomical aspects of the olfactory system with specific emphasis placed on the olfactory neurons, vomeronasal organ, the trigeminal nerves, the septal organ and the nervous terminals. Excellent diagrams are included.Ω

Yefimov, A. "Mines on the Roads." Red Star August, (1986): 2. In addition to a description of the use of dogs in clearing roads of mines, the article states that the dogs can detect the most sophisticated plastic explosives, which a normal mine detecting device cannot.

Zimmerman, Richard. Crescent Newsletter XI. This newsletter lists contacts for the Australian Police and Service Dog Association, The Canadian Police Canine Association and a world famous tracking trainer by the name of Glen Johnson, who wrote the book, Tracking Dog Theory and Methods.Ω

Zimmerman, Richard. "Shepherds and the Wolf." Crescent Newsletter XII. This article describes the importance of early imprinting in making an effective sheep dog. Mr. Zimmerman relates that when the pups are about 15 to 16 days old the pick of the litter (most aggressive nusser), male or female, is placed in a box lined with sheep wool clippings and is isolated from all dogs and people, except the handler. Several times a day the puppy is allowed to suck on a nursing ewe that is brought in and held down for the puppy to nurse on. This procedure takes advantage of the dog's pack instinct, and the dog begins to think that he is part of the flock or family pack. Zimmerman states that due to the dog's drive to be "Boss", the sheep will then look to the dog for protection and direction. He also states that the primary reason the Shepherd is preferred is because of the "pack protective instinct" that has been passed down from the wolf.Ω

Zwickley, Jared. "Is There a Future for the Police Canine?" California Commission on Peace Officer Standards and Training, 1987. This independent study makes the following conclusions:

- 1) The dog's use will change in some areas, but increased demand will be made for narcotic and explosive dogs.
- 2) General patrol assignments will continue, but the dog will not be permitted to bite a person unless it is absolutely necessary.

- 3) The use of dogs could be restricted or eliminated through misuse or poor management.
- 4) The concept of management must expand in order to address the outside forces that exert influence on the working dog program.
- 5) Future leaders should develop an entrepreneurial approach by taking the initiative to implement change before it is mandated by others.
- 6) Leaders must be future focused.Ω

Description of Contacts

Amm, Brian - Mr. Amm belongs to the Canadian Police Canine Association.

He was recommended by Richard Zimmerman as an excellent source of information about the procurement, training and use of working dogs in Canada.

Andersen, Gary, LTC - LTC Andersen is the Chief, Internal Medicine, DOD Military Dog Veterinary Service at Lackland Air Force Base. He has over 18 years experience working with MWDs, and is currently the AMEDD Consultant to the Surgeon General on MWDs (since 1988).

Arnold, Louise - Ms. Arnold is the librarian in charge of the History Reference Branch of the U.S. Army Military History Institute.

Bailey, Cheryl - Librarian at the American Kennel Club.

Ball, Jim - Mr. Ball is the computer systems analyst at Marshall Farms. He is also in charge of the breeding programs for this organization.

Barger, David - Sgt. Barger is the National Secretary of the National Police Bloodhound Association.

Beaver, Bonnie, B.S., D.V.M., Ph.D - Dr. Beaver is a Full Professor of Animal Behavior, College of Veterinary Medicine, Texas A & M University.

Bickel, Carl - Mr. Bickel is the Librarian at the National Criminal Justice Reference Service.

Bielfelt, Sherman - Mr. Bielfelt worked as a statistician on an NIH grant at Guide Dogs for the Blind, Inc. from 1961 to 1966. Since then he has worked as a consulting statistician and geneticist for numerous companies. From 1975 to the present, he has been a consultant on statistics and genetics for Guide Dogs for the Blind, Inc.

Bowen, Richard, D.V.M. - Dr. Bowen is a Full Professor in Reproductive Physiology at Colorado State University.

Boyce, John R., D.V.M. - Dr. Boyce is the Assistant Director for Scientific Activities for the American Veterinary Medical Association.

Brackman, Jane L. - Ms. Brackman is the General Manager for International Guiding Eyes, Inc.

Brannaka, D.C. - Mr. Brannaka is the canine coordinator/trainer for the Southeastern and South central regions within the Plant Protection and Quarantine Programs of USDA-APHIS.

Branyon, Ginger - Ms. Branyon has been working with search and rescue and police dog teams since the early 70's. As such, she has a lot of experience working with Bloodhounds and German Shepherds.

Brown, Hildegarde - Ms. Brown is the Chief, Public Affairs Office, of the DODDC.

Bull, R.W., D.V.M. - Dr. Bull is a Full Professor in Reproductive Physiology at Michigan State University.

Burke, Dennis - Mr. Burke is in charge of Procurement of dogs for the U.S. Customs Service.

Burns, James, D.V.M. - Dr. Burns is the President of Ridglen Farms, Inc.

Burr, John, D.V.M. - Dr. Burr is the Animal Care Center Veterinarian at Iams.

Burwell, Tom, Maj. - Maj. Burwell was the Officer in Charge of the Systems Analysis of the MWD Program. He was recently transferred to another section within the same command.

Caldwell, Charles - Mr. Caldwell is the Director of the Canine Enforcement Program for the U.S. Customs Service.

Carrol, Tom, D.V.M. - Dr. Carrol is the Clinical Veterinarian for Hazelton Research Products, Inc.

Christopher, Brother. Brother Christopher is the POC for the Monks of the Brotherhood of Saint Francis. This organization has been breeding and training working dogs for many years. Jim Watson provided the referral. (Author's Note: Directory Assistance also said that the Monks also "make great cheese cake"!)

Clark, Terry - Mr. Clark worked at the overseas DODDC in procurement from 1986 to 1989. Awaiting information.

Clark, William, COL (Ret) - COL Clark is currently writing the history of the U.S. Army Veterinary Corps in Vietnam. He has a wealth of data on MWDs for that time. COL Clark also has almost 30 years experience in the U.S. Army Veterinary Corps.

Cooper, James, COL - COL Cooper is the Chief, Veterinary Science Division, Academy of Health Sciences. From 1985 to 1988, COL Cooper was the Command Veterinarian in Europe, in which one of his many responsibilities involved the oversight of veterinary support for the MWDs in Europe.

Coppinger, Raymond, Ph.D - Dr. Coppinger is a Professor of Biology at Hampshire College, and is the author of numerous scientific articles on

breeding, genetics and statistics, of which some are referenced in this thesis.

Craig, Dan J., D.V.M., M.S. - Dr. Craig is the Chief, Animal Behavior Section, 3280 TCHTG/TTMDB, USAF Security Police Academy, Lackland Air Force Base. Dr. Craig has occupied this position since 1974. He has a Master's Degree in Experimental Psychology. Dr. Craig has developed numerous systems designed to identify specific responses that predict trainability, and to apply statistical analysis in the development, evaluation, and validation of the various training protocols used in the MWD training programs at the DODDC. Awaiting statistical information.

Dailey, Robert - Trainer/seminars on detection. - Awaiting information.

Davis, Wayne - Mr. Davis is the Director of the West Virginia Canine College. He expects to publish a book on dog training sometime in 1990.

Davola, Peter, SSG - SSG Davola is in charge of the recertification of MWDs, and Kennel Master for Headquarters, TRADOC. He has been involved in training and competition with civilian police working dogs since 1975. He is also the President of Region # 11 of the United States Police Canine Association, Inc. Awaiting further video tape information.

Dennis, S.J., Captain. Captain Dennis is the Chief of the Operational Law Enforcement Division for the U.S. Coast Guard.

Devaney, Matthew - Mr. Devaney is the Deputy Director in charge of training for the Alabama K-9 Law Enforcement Training Center.

Dorly, Jeffrey - POC for the Gazette, American Kennel Club.

Drexler, Rudy - Mr. Drexler is owner and operator of Rudy Drexler's School for Dogs.

Dunlap, Harris L. - Mr. Dunlap has been involved breeding and raising sled dogs since the early 1970's. He is the owner and manager of Zero Kennels. He also conducts breeding and nutritional research in coordination with Cornell University and ALPO Petfoods.

Durrant, Geoffrey R., Brigadier - Brigadier Durrant is the Director, Army Remount and Veterinary Services, British Royal Army Veterinary Corps.

Dutton, Ron, LTC - LTC Dutton has had numerous assignments as a U.S. Army veterinarian dealing with large numbers of MWDs, both in Europe and South Korea. He is currently the Chief, Department of Instruction, Division of Veterinary Medicine, WRAIR.

D'Ver, Abbott S., D.V.M. - Owner of White Eagle Laboratories.

Eden, Robert S. - Mr. Eden is the Director of the K9 Academy For Law Enforcement. This is a consulting agency designed to assist organizations setting up K9 programs. They also do custom training and screen dogs for placement. Mr. Eden is also the author of a book described in this thesis.

Eklund, Trudy - Ms. Eklund is the Librarian for the Army Center for Military History.

Fält, Lars, Ph.D. - Dr. Fält is a free lance ethologist, and is also a co-author of an abstract cited in this thesis.

Fenton, Jeff - Mr. Fenton was referred to the author by Robert Eden, as someone who knew the MWD Program. Mr. Fenton is a police sergeant for the Phoenix City Police Department, Phoenix, AZ. He is also in charge of running the state police dog school.

Fox, Frank, Jr. - Mr. Fox is in charge of Professional Relations at ALPO

Petfoods, Inc. He referred the author to Harris Dunlap for current information on research conducted or sponsored by ALPO on dogs.

Francis, Ron, MAJ - MAJ Francis is the U.S Army representative on the Joint Service Military Working Dog Committee (JSMWDC).

Frost, David - Mr. Frost has experience as a trainer and Kennel Master at the DODDC from 1974 to 1988. He is currently training and handling working dogs for the Tennessee Valley Authority.

Fuller, William, D.V.M - Referral from Glen Johnson. Dr. Fuller has extensive knowledge of canine behavior and selection of temperament attributes. He has studied with Dr. Bodingbauer and has worked with Dr. Castleberry on the biosensor program.

Gilman, Martin, D.V.M. - Dr. Gilman is the clinical veterinarian for Hazelton LRE.

Ginsburg, Benson, Ph.D - Dr. Ginsburg is a Professor of Biobehavioral Sciences/Psychology, and is the Chair, Behavioral Genetics Laboratory, at the University of Connecticut.

Goddard, M. E. - Dr. Goddard have written many scientific articles in reference to the selection of dogs to be guide dogs. A few of the articles are referenced in this thesis.

Girsh, John - Mr. Girsh is the Farm Director at the U.S. Disciplinary Barracks, and could provide valuable input into any considerations of utilizing inmates in a kennel program.

Grünrowsky, Manfred - Mr. Grünrowsky is a German policeman who has expertise in the utilization of dogs by the German Police.

Haake, Susan - Ms. Haake is the Librarian for the California Commission on Peace Officer Standards and Training.

Hammon, Shirley - Ms. Hammond is the Vice President of the California Rescue Dog Association (CARDA). CARDA is a nonprofit organization composed of volunteer search and rescue dog units.

Hayter, Dan - Mr. Hayter is the Director/President of Global Training Academy. He has over 24 years experience in handling and training dogs. He was an instructor and Course Chief of the Explosive Dog Handlers Course, DODDC for over 10 years, and was the Explosive Dog Coordinator between the DODDC and the FAA for 5 years. During the 1984 Olympic Games, Mr. Hayter was the supervisor of all explosive dog teams. He was awarded the Air Force Master Instructor Badge during his service in the U.S. Air Force.

Helm, Frederick, COL - COL Helm has over 15 years experience providing veterinary care to MWDs. He was the initial Veterinary Corps Officer involved in the negotiation of the Inter Service Support Agreement of the DODDC in 1982. He is currently the Deputy Commander for Veterinary Services, Walter Reed Army Medical Center.

Houpt, Katherine, D.V.M. - Dr. Houpt is the President of the American Veterinary Society for Animal Behavior, and is a Full Professor in Physiology at Cornell University.

Hughes, Nyla - Ms. Hughes is the POC for the Purina Kennel News®.

Irving, Betsy - Ms. Irving is in charge of the foster home program at the Guide Dogs for the Blind.

Jarvis, Lynn, Ph.D - Dr. Jarvis is a research scientist at Microsensor Systems, Inc. He is very capable to discuss the current state-of-the-art of microsensor technology and its application today.

Jepson, Paul, LTC - LTC Jepson works with Brigadier Durrant in the Army Veterinary and Remount Services of the British Royal Army Veterinary Corps.

Jerszyk, Marion, Ph.D - Dr. Jerszyk is the staff geneticist at The Seeing Eye, Inc.

Johnson, Carl, D.V.M - Dr. Johnson is the POC for the International Embryo Transfer Society.

Johnson, Glen - Mr. Johnson is considered an expert (Schwartz, Zimmerman) in the procurement and training of tracking dogs.

Johnston, Shirley, D.V.M., M.S., Ph.D - Dr. Johnston is an Associate Professor in Reproductive Physiology at the University of Minnesota. She is also the President of the American College of Theriogenology. She was referred to the author by LTC Dutton.

Jolivette, Gerard, Capt. - Capt. Jolivette is the Air Force Representative on the JSMWDC.

Kay, Debbie - Ms. Kay is the owner and President of International Detector Dogs, LTD. She is in the process of publishing a book on accelerant training, and has another book, 6 years in the making, that is about how to produce an advanced strain of Labrador Retriever. According to Ms. Kay the book will discuss the mechanisms of inheritance for many of the working dog characteristics, and explain the reasons for success and failure in trying to select for these attributes. She has over 20 years of working dog experience and has bred over 5,000 dogs.

Kilby, Edward - Mr. Kilby is the Corresponding Secretary for the AMERICAN BLOODHOUND CLUB.

Kraemer, Duane, D.V.M., Ph.D - Dr. Kraemer is an Associate Professor of Reproductive Physiology at Texas A & M University. He reported some of the earlier data concerning artificial insemination in the dog.

Kronschnabel, Alan - Awaiting information. Referred to the author by Peter Davola.

Lammers, William, D.V.M. - Dr. Lammers is the Superintendent of the San Antonio Texas Animal Control Facility.

Lanting, Frederick - Mr. Lanting has been actively involved with German Shepherds since 1947, and is the author of a book on that breed that is due out in May 1990. He is also a columnist for several magazines and newspapers. He is an organic chemist by training.

LeVine, Gary - Mr. LeVine is a commercial dog breeder. He also "custom" develops breeds of dogs.

Leber, Cathie - Ms. Leber is the POC for the Guide Dogs of the Desert, Inc.

Lees, George, D.V.M., M.S - Dr. Lees is currently a Professor of Small Animal Medicine at Texas A & M University. He has experience working with the biosensor program.

Leighton, Eldin, Ph.D - Dr. Leighton is a technical consultant in genetics. As such, he is the consultant for The Seeing Eye, Inc. He was also a research geneticist on the biosensor program from January 1974 to June of 1976.

Linn, Jeffrey, D.V.M. - Currently, Dr. Linn is the Attending Veterinarian for University Laboratory Animal Resources, University of Pennsylvania. Dr. Linn also worked on the biosensor program from 1967 to 1976. During

that time he began as the small animal veterinarian, then moved up to the Project Manager (1969-1970), and was the Deputy Director during 1970-73; 1974-76.

Luther, William A. - Mr. Luther is the Director of Research Development for Auburn University.

Maaf, Wim - Mr. Maaf is a dog broker for the Belgian Malinois and German Shepherd in Holland. The author was referred to Mr. Maaf by David Reaver.

McDonald, Jack - Mr. McDonald is a Master Trainer for the Pierce County Sheriff's Department. He also trains canine teams throughout the state of Washington.

Mackenzie, Stephen, Ph.D - Dr. Mackenzie is a Full Professor at State University of New York. His Ph.D thesis was in behavioral genetics. He wrote his Ph.D Dissertation using data from the biosensor program. Much of that data is still unanalyzed. The author was referred to Dr. Mackenzie by Dr. Leighton. Dr. Mackenzie also has extensive experience training and handling state police dogs, and has conducted research on the tracking abilities of the dog.

MacMurray, Michael - Mr. MacMurray is the Country Director for Pakistan, Afghanistan and Bangladesh, for the Office of the Assistant Secretary of Defense. Mr. MacMurray was a referral from LTC Thorton.

Mardolis, Mathew - Trainer - The author learned about Mr. Mardolis from a segment about his work in Hard Copy, a news special produced by Paramount Pictures, Inc. Awaiting information.

Martin, Dale, MAJ - MAJ Martin is currently Chief, Department of Respiratory Research, WRAIR. From 1985 to 1988, MAJ Martin was the

Chief of the MWD Referral Center, and Chief of Veterinary Support to the DOD Dog Buying Team in Europe.

Mathews, Nancy. - Ms. Mathews is the POC for the American Kennel Club.

May, Joyce - Ms. May is the POC for the Humane Society of the U.S.

McCathern, Marge - Ms. McCathern is the POC for procurement statistics and costs at the DODDC.

McDermott, Pat, Ph.D - Dr. McDermott is in charge of setting up DOD-sponsored research for B-K Dynamics. This company organizes seminars such as the Defense Science Board, Summer 1987.

McDowell, Edmund F., Jr - Mr. McDowell is the Special Agent in Charge of the Secret Service Canine Section. Mr. McDowell was referred to the author by Dennis Burke.

McEathron, Gene - Currently, Mr. McEathron is a Deputy Sheriff of Warren County. He has over 39 years law enforcement experience in military, federal and civil enforcement fields. He was the Director of the Canine training for the U.S. Customs Service, and prior to that he was the Course Chief of the U.S. Air Force Department of Security Police Training Patrol Dog Course.

McPherson, Robert - Mr. McPherson trains dogs for the Secret Service.

Meloy, Paul - Mr. Meloy is the President of the United Schutzhund Clubs of America - Awaiting information.

Meyers, Larry J., D.V.M., M.S., Ph.D - Dr. Meyers is the Director of the Institute for Biological Detector Systems, and is a leading research scientist of canine olfaction. He is also the point of contact for the International Society For Working Dogs.

Mitchell, Tom - Mr. Mitchell has 17 years experience in dog training, especially the Schutzhund sport. He has qualified 3 times for the World Championship team.

Mueller, Lance, MAJ - MAJ Mueller is the U.S. Marine Corps representative to the JSMWDC.

Mullican, Herbert Jr. Referral from Dr. Mackenzie. Mr. Mullican is a former USAF Security Police NCO whose law enforcement career was cut short from injuries incurred while in the line of duty. He says he has spent many years conducting research on how to enhance the capabilities of the working dog. He also states that he has a large computer database of bibliographic information. The author was not able to confirm the extent of the database due to time constraints.

Murphy, Jeannette - POC for the Perdy Prison dog training program.

Nakasone, Irene - Ms. Nakasone is the POC for Science Applications International.

Nixon, Peter - Mr. Nixon is the President of the Australian Police and Service Dog Association. He is also the Commander of the North Region Police Dog Squad.

Noll, Robert - Mr. Noll is an Explosives Enforcement Officer for the Bureau of Alcohol, Tobacco and Firearms, with special emphasis on dogs.

Norman, Terry - Mr. Norman is the Director of Resources at the U.S. Disciplinary Barracks. He would be a good initial contact for exploring the feasibility of using inmates in a MWD kennel operation.

O'Boyle, Ernest H. - Mr. O'Boyle is a police specialist for the National Criminal Justice Reference Service.

Ohrn, Elinor - Ms. Ohrn is the Editor, Purina Kennel News®.

Olsen, Patricia, D.V.M., M.S., Ph.D - Dr. Olsen is a specialist in canine reproduction, an Affiliate Professor at Colorado State University, and a Diplomate of the American College of Theriogenology.

Outman, Robert - Mr. Outman is the Owner of ;ADD. This company uses dogs to inspect houses for wood-destroying insects. The company has been in operation since 1979. Awaiting information.

Padgette, George, D.V.M. - Dr. Padgette is a Full Professor in Veterinary Pathology at Michigan State University.

Parker, Bonnie - Ms. Parker is the POC in charge of documents at the California Commission of Peace Officer Standards and Training.

Parks, James G. - Mr. Parks has over 29 years experience in the U.S. Air Force Security Police. He has over 6.5 years classroom, field instructor, and training development. He is currently the Director/Secretary/Treasurer of Global Training Academy.

Patterson, Don, D.V.M., DSc. - Dr. Patterson is Chief, Medical Genetics, University of Pennsylvania.

Platz, Carol, D.V.M. - Dr. Platz is the POC for International Canine Semen Bank, Inc. Dr. Platz is a referral from Dr. David Wildt.

Pouliot, Michele - Ms. Pouliot is the Training Supervisor at Guide Dogs for the Blind.

Proctor, John, Ph.D - Dr. Proctor is the Senior Vice President for B-K Dynamics. Refer to McDermott.

Rall, Bill, Ph.D - Dr. Rall is a cryobiologist who is working with Dr. Wildt on feline embryo transfer.

Rankin, Grady - Mr. Rankin is the President of International Canine Genetics, Inc.

Reardon, Michael J., COL - COL Reardon is currently the Director of the Medical Chemical Defense Research Program, USMRDC. His experience with MWDs goes back to 1968 in Okinawa through 1971 as the Officer In Charge of MWD hospitals at Cam Ranh Bay and Long Binh, Republic of Vietnam.

Reaver, David - Mr. Reaver is the founder and owner of Alderhorst International, Inc. Mr. Reaver has many dog broker contacts on the European continent, and states that he has the largest civilian dog training school in the world.

Reese, Dan - Mr. Reese is a dog trainer for the U.S. Customs Service.

Richner, Allan - Mr. Richner is the Treasurer of the National Police Bloodhound Association. - Awaiting information.

Rimbey, Glen - Mr. Rimbey is a Major at the Penitentiary of New Mexico, and is in charge of the K-9 Unit. He has over 40 years experience working with dogs. He was referred to the author by Ed Kilby, as the premier Bloodhound expert within the U.S.

Ritter, Joan - Mrs. Ritter is the Operations POC for Guide Dogs for the Blind.

Robb, Judy - Mrs. Robb is involved with the use of dogs in search and rescue operations in Northern California. She has been a Bloodhound enthusiast for over 25 years, and has conducted public relations work on the use of dogs in law enforcement for the past 16 years.

Roberts, Doug - Mr. Roberts is in charge of training at The Seeing Eye, Inc.

Robinson, Russell D. - Mr. Russell is the Site Director for Hazelton-LRE.

Robles, Mel - Mr. Robles is the dog training coordinator for the Western Region of USDA-APHIS. Awaiting information.

Rogers, R. O. - Mr. Rogers is the editor of the USCPA-sponsored publication Canine Courier.

Royal Dutch Police Dog Association (KNPV) - This organization is responsible for the breed registration and training certification for the German Shepherd and the Belgian Malinois in Holland.

Schäferhund Verein - This organization is responsible for the breed registration and training certification for the German Shepherd and the Belgian Malinois in the Federal Republic of Germany.

Schmeltzer, Nick - Mr. Schmeltzer is the Kennel Manager for Hazelton-LRE.

Schroeder, Calvin and Penny - Penny Schroeder is the Puppy Chairman for the National Police Bloodhound Association.

Scofield, Jan. Mr. Scofield is a Master Trainer and importer. He is a referral from Jim Watson. Awaiting information.

Scott, J.P., Ph.D - Dr. Scott has produced and co-produced many papers on the subject of canine behavior and socialization. He is still very responsive and willing to discuss his work and offer valuable insight.

Sexton, Ted - Mr. Sexton is the Director of the Alabama Canine Law Enforcement Officers Training Center. He is also a graduate of West Germany's service dog training school. Mr. Sexton's school is supposedly the 3rd largest non-governmental training school in the U.S (Bernhardt: 41, Reaver).

Shaffer, James - Mr. Shaffer is the President of the National Police Bloodhound Association.- Awaiting information.

Shifflett, Ken - Mr. Shifflett is the POC for the U.S. Army Foreign Science and Technology Center.

Simon, Mike - Mr. Simon is the Western Region Coordinator for USDA-APHIS.

Slavik, Don - Mr. Slavik is the National Secretary for the United States Police Canine Association, Inc.

Slonaker, John J. - Mr. Slonaker is the Chief, Historical Reference Branch, U.S. Army Military History Institute.

Smith, Jim - Mr. Smith is in charge of the APHIS dog inspection teams for the eastern U.S.

Stamp, Gary L., LTC - LTC Stamp is currently the Chief, Veterinary Medicine and Professional Programs Division, HQ, Health Services Command. LTC Stamp has also been involved with the MWD Program since 1976. The various positions held include Chief, Outpatient Clinic; Chief, MWD Referral Center, Ramstein, West Germany, and Chief, Medicine and Surgery, DODDC.

Stout, Bill - Mr. Stout is the POC for the U.S. Government Bookstore.

Strobel, Richard, Ph.D - Dr. Strobel is the POC for the Forensic Science Laboratory of the National Laboratory Center.

Stroud, Perry, MACM - MACM Stroud is the Navy representative to the JSMWDC.

Stuart, Robert - Mr. Stuart is the POC for the publication, K-9 Enforcer.

Sundgren, Per Erik - Dr. Sundgren is a canine geneticist at the Swedish University of Agriculture. He has over 30 years experience in animal breeding.

Taylor, Bill - Mr. Taylor has over 30 years experience as a trainer, handler, instructor, Kennel Master, kennel attendant and evaluator at the DODDC. He is currently the Chief, Operations Branch, DODDC.

Taylor, Earl V., LTC. LTC Taylor is the Commander of the 3280th Technical Training Group. This is the organization that is responsible for training the MWDs.

Tecec, Thomas, LTC - LTC Tecec is currently the Deputy Commander for Veterinary Services, Fort Leavenworth, Kansas. His previous experience with MWDs came with the assignment of Chief, Plans, Operations and Animal Medicine, HQ, 7th Medical Command, DACS, Veterinary Services.

Thorton, William, LTC - Health Services Officer at the Center for Low Intensity Conflict. He has written numerous papers on the use of MWDs in low intensity conflict.

Theriot, George - Mr. Theriot is an expert on the Schutzhund organization within the U.S. Awaiting information.

Tomlinson, Sam - Mr. Tomlinson is a research scientist, Department of Biosciences and Bioengineering, Southwest Research Institute.

Turbiville, Graham, Jr., Ph.D - Dr. Turbiville is a Soviet military expert. He was very willing to search the Soviet literature for topics relevant to this thesis.

Urena, Patricia - Ms. Urena is the POC for the California Board of Guide Dogs for the Blind.

Voith, Victoria, D.V.M., Ph.D - Dr. Voith is an animal behaviorist. She recently joined the DODDC staff as the Animal Behavioral Consultant

Walbert, Calvin - Mr. Walbert is the Program Manager for the Explosive/Detector Canine Team Program, FAA.

Walther, Kathleen - Ms. Walther is the POC for the Humane Society of Bexar County.

Ward, James D. - Mr. Ward is currently in charge of procurement at the Overseas Dog Buying Center. Awaiting additional information.

Watson, Jim - Mr. Watson is the POC for the North American Police Work Dog Association.

Weidel, Michael - Mr. Weidel is an Attorney-at Law. He is also a Bloodhound owner, breeder, and trainer. In addition, he is a member of the Illinois Search and Rescue Service, and the National Police Bloodhound Association.

Weitzel, Horst - Mr. Weitzel is a dog broker in Western Germany. He was referred to the author by Mr. Reaver.

Wells, Dean - Mr. Wells is a Master Trainer and breeder. He is a referral from Jim Watson.

Whitstock, Robert - Mr. Whitstock is the Vice President of The Seeing Eye Inc.

Wildt, David, Ph.D - Dr. Wildt is the Head of the Reproductive Biology Section of the National Zoological Park.

Wilsson, E. - Dr. Wilson is a behaviorist for the Swedish Dog Training Center. Awaiting information.

Wolfle, Thomas, D.V.M., Ph.D - Dr. Wolfle has conducted research on canine behavior and wrote an article on canine socialization that is included in this thesis.

Wyler, Jan - Ms. Wyler is the POC for the Society for Theriogenology and the American Embryo Transfer Association.

Wysocki, Charles, Ph.D - Dr. Wysocki has done extensive research in canine olfaction. He is an associate member of the Monell Chemical Senses Center, and an Associate Professor of the University of Pennsylvania.

Zimmerman, Dick - Mr. Zimmerman is the editor of the Crescent Newsletter.
Zwickey, Jared. - Mr. Zwickey is a lieutenant for the Concord Police Department. He wrote a report entitled, "Is There a Future for the Police Canine?". The article is referenced in this thesis.

CHAPTER 5

Summary

Conclusions

The lack of an organized system to consolidate and to standardize pertinent information about the production and further development of working dogs is an industry-wide problem. Ample information, resources, and expertise exist and can be used to ensure the optimum operation of any working dog program. This study includes a broad spectrum of sources of knowledge and expertise that is necessary to produce high quality and top performing working dogs. This spectrum of knowledge, whether objective or subjective, describes the integral synergism between the science and art (expert eye) that is essential in a successful working dog program.

Recommendations - MWD Program

The majority of the information described in this thesis is not static. As a result, the author recommends that an information management system be established to record the lessons learned and to glean from the recommendations and time-tested procedures observed since World War II. It would seem prudent that the sources of information described in this thesis should be included in the information system and should be updated as appropriate. The institutionalization of this information could then serve as a foundation for further update, reference, and study. Many of the problems, recommendations, and "unique" situations described since World War II are still applicable today. The majority of the current problems and

challenges associated with the MWD Program could be solved and prevented simply by studying and learning from the past.

Implications of the Study

The problems created by the absence of a centralized source of information, as it relates to success in a working dog operation, include the following:

- Lack of standardization for procurement and training
- Lack of agreement on different methods, principles, and objectives
- Lack of communication within the industry
- Absence of an entity that is primarily responsible to manage information to ensure ready access and quality control
- Personal opinion and bias in the pool of expertise

The author noted the existence of a chasm that separates knowledge obtained through the scientific process and knowledge that is less quantifiable, but nevertheless exists and plays a crucial role just as does art in the practice of medicine. However, in the case of producing working dogs, there is a lack of acceptance and an unwillingness to view the other side of the coin, whether it be science or art.

As a result, there is a lack of communication, cooperation and sharing of resources. The end result is an inability to understand the working dog profession in its entirety. The information contained within this thesis is intended to serve as a baseline of information for those concerned with the production of working dogs. Anyone who justifies his/her bias based on a lack of alternative view points will not find justification for that bias in

this thesis. Almost everyone the author communicated with expressed a willingness to share information, and yet, many were not aware of the resources in their own backyards or at the computer terminal or at the telephone. The author does not maintain that this thesis is all inclusive, but only that it can broaden the "fish bowl" perspective and can enhance the understanding and production of working dogs.

In order to establish standards for procurement, training, and the use of MWDs, the available scientific methods and expertise must be employed. It would thus seem prudent to first fund the research that would generate the data needed to address the issues described in this thesis. This would require the development of liaisons with civilian breeders, trainers, procurement contractors, and research institutions. This cooperation would be beneficial for all concerned, not only to stimulate the flow of ideas and resources, but to solidify professional respect and to bring into focus the end objective: efficiency in producing top quality, high performing MWDs.

Prior to considering a specific category, method, principle or view expressed herein, it is crucial to establish specific goals and have an awareness of the internal and external factors that may impinge on the successful outcome of a specific working dog operation. This is particularly true for any organization that is under the control or strongly influenced by the government. Plans and goals need to be flexible for changing times.

As mentioned in Chapter 1, no attempt has been made to validate or substantiate statements or claims made from the various sources of information. Instead, correlations and contrasts of views have been presented to allow the reader a more complete and objective view. Common

themes for procurement, selection criteria, training, command and control (management), and contributions of technology follow. The recurrence of these common themes throughout the study, in the opinion of the author, merit further examination.

The range of procurement sources includes breeding programs, acquisition from animal pounds and humane shelters, public donation or purchase, and purchase from a breeder or trainer. Each option has its unique advantages and drawbacks. Examples of each have been included.

The breeding program offers many options, to include inbreeding, outbreeding, line breeding, and combinations thereof. Artificial insemination and embryo transfer may offer significant benefits, especially at the beginning of a breeding program. Time, money, and long term commitment are the drawbacks. Public donations and acquisition from animal shelters are less expensive, but the time and effort required to find quality dogs is significant, and the chances of finding enough good dogs are limited. Most organizations that procure dogs this way must screen at least 50-100 dogs before finding one they decide to keep.

Public awareness that the military is giving condemned or neglected animals a chance to serve a useful purpose could bring ever-increasing accolades from a public that is intensifying its concern for animal welfare protection and preservation of life. Even if this method is inefficient, the benefits of public approval could enhance acceptance of the other aspects of the MWD Program. The estimated number of dogs destroyed nation-wide in 1987 ranged from 6.3 to 10.4 million (Olsen). In San Antonio, Texas, alone 41,000 dogs were euthanized in 1988 (Lammers, Walthall). Would it be too

liberal to suggest that possibly 0.1 per cent of those dogs could have qualified as MWD training candidates?

It is the author's opinion that 10 times that number could qualify, but the end may not justify the resources required to find that select number; most certainly this would be true using current methods of selection.

Procurement from a breeder or trainer places heavy reliance on the source and less control over what is received, and it subjects the buyer to *caveat emptor*. This highlights a common theme among numerous respondents, the need for an experienced eye. This experience does not come solely from reading a set of standards or guidelines.

Specific information relating to training methods was sparse, but the emphasis on different ways to stimulate a dog to work were quite diverse. Methods discussed include retrieve drive, play drive, food drive, water drive and praise. The majority of the respondents also took the time to express why they preferred one or more methods over the others. Another variable that appeared to determine preference was acknowledgement of a dog's individuality, not only in genetic variability, but also in temperament. Chao stressed the universality of the "Bowser Principle." Documentation of training evaluation and the importance of multiple evaluators was also evident.

Many respondents also expressed agreement on the importance of socialization and its role in preparing a dog to complete training. The most crucial time is from birth to 16 weeks of age, although the next 8 months are also very important in exposing the dog to the sounds, sights, and events of life. Socialization poses a significant challenge to breeding programs. Most respondents have designed extensive foster home programs that begin

between the 12th and 16th week of life and return the dog for formal training by the 12th to 18th month after birth. There are large breeding facilities that produce dogs for research, but the spectrum of socialization and exposure to every day experiences appears to be quite narrow. These dogs may have to perform under stressful situations, such as daily dosing for months or years at a time, and must be easy to handle or restrain at all times. But the extent of this type of socialization would not be adequate for a MWD to perform in an acceptable manner in the field. Based on discussions with personnel from these facilities, it appeared to the author that a lot of emphasis is placed on breeding for the right temperament. Many of these organizations have over 20 years of experience breeding large numbers of dogs. Some maintain up to 14,000 dogs on site on a daily basis.

Rejection rates at procurement and during training also play significant roles in determining the success rate and the cost efficiency of any working dog program. Selection from animal brokers appears to have rejection rates of around 50 per cent, whereas most organizations that procure from animal shelters go through up to 100 dogs or more before finding one they keep. Up to 80 per cent of the progeny of a breeding colony may not meet the requirements set for training candidates. Although the per cent that qualify for training appears to be highly correlated to the training criteria, experience of the trainers and the flexibility of a socialization and training program also occupy important roles. One respondent (Kay) claims that she can design a breeding program from which all the progeny are not only selected for training, but also complete training. To accomplish this she sets very specific goals for her breeding program, and socialization and training are directed to individual

temperaments. The rejection rates during training appear to be much less from breeding programs than from other types of procurement. An acceptable rejection rate during training usually was indicated to be less than 10 per cent.

A crucial factor that significantly affected the rejection rate was the requirement of single versus dual-purpose dogs. On first impression, it would appear that a dual-purpose dog would be more cost effective and would have a greater utility, but a large number of the respondents felt just the opposite.

Breed preference appeared to center around the German Shepherd and the Labrador Retriever for patrol and detection work, respectively. However, some of the Using Agencies were sensitive to the dog's public image. They felt the image of the MWD has been tarnished by the civil rights riots of the 1960's and the Vietnam War. As a result, these agencies felt that a less threatening dog, such as a poodle or Beagle, would be more effective on a congested urban landscape, such as would exist at an airport or on a ship.

The goal of management should be to facilitate mutual support and cooperation between the various phases/sections that produce MWDs. Effective management creates an environment that allows the organization to meet the challenges and to solve its problems. Ineffective management generates rivalry, jealousy, parochialism, and disunity. In this age of daily change, capability lies in flexibility. Fragmented executing authority, coupled with the absence of a centralized source of information on working dog production leads to the compounding of the bureaucratic inertia that is built into the current MWD Program.

Embryo transfer technology, cloning, and transgenesis offer exciting options for maximizing the dog's potential. Technological advances in microsensors, with their multiple arrays of sensing capabilities, also serve as competitors of the dog. However, the dog remains at the forefront, both in terms of capability and versatility, if only by a nose. With respect to capability, and in many ways versatility, much research is required in order to fully understand and maximize the dog's unique sensing attributes. Again, whatever the resources, situation, or intent, the expertise and knowledge is available for application if clearly defined objectives are established and a commitment is made. There are many dedicated, intelligent people who are involved in working dog production, but who do not see the big picture because of a lack of cooperation, communication, unity, and common goals.

Implications For Further Research

Implications for further research are based upon 4 common themes observed by the author. These themes are: 1) the importance of a master plan, 2) command and control, 3) methods of procurement and 4) the impact of rejection rates on the quantity and quality of the end product. These themes are closely related, but they will be discussed separately in order to highlight specific recommendations.

MASTER PLAN - Based on a review of recommendations made on the MWD Program since 1968 (Air Force, Burwell, Combined Arms Center, Linn, McIntire), the first and foremost recommendation is that a master, interservice plan be formulated. This plan might consider methods to synthesize procurement, training, deployment, employment and sustainment actions into a synchronized, coherent whole. In addition, consideration

should be given to ensure that the plan be central in its direction, and that it be understood and approved by the senior leadership. The following is a list of questions that might be considered to fulfill that end:

- Could the establishment of milestones and perceptive objectives facilitate formulation of the plan?
- Is the current MWD system structured in the spirit of AR 11-28, or a comparable Air Force regulation?
 - ◆ Could the management system described by Checkland be of benefit in assessing the MWD Program?
- Does the current military mind-set accommodate for all of the unique requirements of the MWD Program? Has adequate consideration been given to the effects of:
 - ◆ Dispersed command and control?
 - ◆ Training procedures of both the dogs and the handlers?
 - ◆ The effects of handler rotation on MWD team cohesion?
 - ◆ The impact of purchase price limitations or inflexibility?
 - ◆ The ability for more responsive acquisition of good quality dogs?
 - ◆ Extension of the MWD working life?
- Do current methods and procedures encourage optimum communication with and response to the concerns of the Using Agencies?
- Could the information contained in this thesis be of value in bringing together the expertise required to develop a composite master plan?

- Could the development of liaisons between the DODDC and civilian breeders, trainers, procurement contractors, and research institutions be of benefit to the MWD Program?
 - ◆ What would be the incentives for participation?
- Is the current MWD Program flexible to the changing demands of the Using Agencies and the potential expansion of MWD missions?
 - ◆ What can be done to minimize the effects of bureaucratic inertia within the MWD Program?
- To what extent does parochialism exist in the current MWD program?
 - ◆ Would the opening up of the MWD Program to participation from outside expertise encourage fresh input to conceptual solutions?
 - ◆ What would be the value of annual conferences for key personnel from the DODDC, members of the JSMWDC, representative from the Using Agencies, and key experts to address current problems and future challenges within the MWD program?
 - ◆ What methods could be employed to enhance communication among all interested parties?
- What would be the value of creating an information management system for the MWD Program that would compile lessons learned since World War II, document time-tested procedures of working dog management, procurement, training and use, and ensure that these sources of information are kept current and are expanded?

COMMAND AND CONTROL - Numerous perceptions (Andersen, Burwell, Fenton, Frost, Parks, Zwickey) are contained within this thesis as they relate to management. Further study directed along lines, intended to answer the following questions may be of benefit:

- Does DOD Directive 5200.31 allow for sufficient command and control, and does it facilitate the existence of a one manager system?
 - ▲ What is the ratio of coordinating versus executing authority under the current directive?
 - ▲ How could the amount of executing authority be enhanced or increased?
- How could the expertise of the U.S. Army Veterinary Corps be more efficiently used in the MWD Program?
 - ▲ What should be the role of the U.S. Army Veterinary Corps to enhance participation by this entity?

PROCUREMENT - This aspect entails a myriad of factors, to include the following: **contractors** (Alderhorst, Drexler), **breeding/genetics methods** (Author Unknown, Remount; Bielfelt; Biosensor; Burns; Burr; Caldwell; Clark, R.; Coppinger; Dunlap; D'Ver; Ginsburg; Goddard; Jerszyk; Kay; Leighton; Mackenzie; McEathron; Morrow; Murphy, J.; Newsletter, Genetic Breeding; Patterson; Soderberg; Wimer) and **technology** (Adams, Allman, Bowen, Kraemer, Padgett, Platz, Rankin). Additional factors discussed within the thesis included: **kennel design and management** (Burr, Burwell, LaVine, Mohrman), **behavior/socialization** (Bell, Beavers, Budiansky, Burns, Burr, Freedman, Goddard, Guide Dogs, Hart, Houpt, International Guiding Eyes, Nixon, Pfaffenberger, Ritter, Roberts, Scott,

Symthe), **labor** (Ball, Burr, Ministry Tape, Murphy, J.), **public acquisition** (Jepson,, Nixon, Thornton), **animal shelters** (Caldwell), **sex/age** (Caldwell, Durrant, Fenton, Jepson, Nixon, Ohrn), **breeds** (Ball, Burwell, Caldwell, Clede, Drexler, Durrant, Fenton, Ginsburg, Goddard, Grunrowsky, Guide Dogs, Humphrey, International Guiding Eyes, Jepson, Jerszyk, Kiddy, McIntire, Nixon, Ohrn - Dogs Nose Around, Ormiston, Pfaffenberger, Reaver, Sundgren, Ustinov, Vladimirov, Walbert, Ward), **economics** (Burns, Burwell, Carroll, Defense, Kay, McCathern - Letter to DCVS, Rankin), and **selection criteria** (Caldwell, Durrant, Fenton, Goddard, Guide Dogs, International Detector Dogs, Johnson, Kay, McDowell, McEathron, Pfaffenberger, Reaver, Rimbey, Rogers, Sexton, Shaw, Sundgren, Taylor, B., The Commission, Ward). The options are legion, and all merit further study in order to determine the best options for the MWD Program. Considerations for further study could include answers to the following questions:

- Should the primary goal of procurement be the development of an American source of dogs?
 - ◆ If the MWD Program cannot procure all the dogs it needs from Europe in a peace time setting, what impact might this have on the MWD missions during war or during an unexpected increase in demand?
 - ◆ Based on specific merits, what method of procurement should dominate, i.e. purchase from commercial breeders or trainers, acquisition from animal shelters, dependence on public donations or sales, or the establishment of a government breeding kennel and/or remount system?

- ◆ What would be the feasibility of using a combination of the above?
- ◆ If a breeding kennel was to be established, would it be feasible to sell the surplus dogs to guide dog operations and state and local police departments?
- ◆ What option would be most feasible to resolve the labor requirement that would be inherent with a breeding kennel?
- ◆ What are the disadvantages and advantages associated with the establishment of a kennel at Fort Leavenworth, Kansas, using the U.S. Disciplinary Barracks (prison inmates) and the Command and General Staff College student population (10 month volunteer socialization) versus expansion of the DODDC or some other site?
- ◆ Would DOD solicitation funds offer potential incentive for civilian participation in pilot research projects?
- ◆ What are the lessons learned from the biosensor program?
- ◆ Where is the data from the biosensor program kept, and has it been analyzed and documented?
- ◆ Should an in-depth evaluation be conducted on the Belgian Malinois to determine the extended utility of this breed in the MWD Program?
- ◆ Could a more representative consensus of expertise be obtained through expansion, refinement, and greater distribution of the questionnaire contained in this thesis?

REJECTION RATES - Based on the information obtained, rejection rates appear to be influenced by: **single versus dual-purpose training** (Burwell, Combined Arms Center, Falt, Defense, Kay, McEathron, Noll, Reaver, Walbert), **training methods for the dogs** (Bernhardt, Chao, Dean, Devaney, Frost, Guide Dogs, Humphrey, International Detector Dogs, McEathron, Kay, Meyers, Mitchell, Mueller, L., Ohrn - Young German, Parks, Pfaffenberger, Pouliot, Roberts, Scott, Sexton), **handler training** (Alderhorst, Brown, Caldwell, Combined Arms Center, Frost, Guide Dogs, Kay, McEathron, Parks), **reported rejection rates** (Andersen, Burwell, Caldwell, Craig, Fenton, Jerszyk, Leber, McCathern-Telephone interview, Roberts, Rogers, Scott, Sexton, Taylor, E., Thornton), and the requirements for **expanded roles** (Bernhardt, Clede, Combined Arms Center, Santiago, Schwartz, Thornton, Zwickey). Objective evaluation of each component could offer potential merit for improved MWD production.

Additional considerations could include an evaluation of the capability of technology to understand the dog's capabilities and to enhance those attributes (Ashton, Mueller, L., Syrotuck, Defense, Dunlap, Francis-Science, Gage, Hepper, Marshall, Meyers, Ohrn - Smell Will Tell, Sisley, Thominson, Wysocki). For example, an adjunct, such as electronic olfaction (Ballantine, Bell, Jarvis, Kindle, Nakasone, Wohltjen, Wright), needs further exploration, and documentation prior to possible implementation.

Last, but certainly not least, an evaluation of the MWD Program in the eyes of the working dog profession could be considered as a way to enhance cooperation and to correct or clear misperceptions on both sides. The following questions should be considered:

- Does the MWD Program have an image problem with the general public?
 - ▲ How real is the working dog profession's view that the MWD program is the red headed stepchild of the industry?
 - ▲ What can be done to improve or correct those perceptions?
 - ▲ What would be the potential public image benefits from procuring a portion of dogs from animal shelters?

All of these recommendations for further study and research reflect questions that seek answers on an industry-wide basis. The MWD Program has the greatest demand for these answers. It also has the greatest potential resources. As such, the MWD Program could once again set the standards of the working dog industry through the efficient production of quality MWDs, and research and development. However, there can be no long term planning without long term funding. The keys to success are commitment, coordination and cooperation, and recognizing that the past is prologue.

APPENDICES

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Appendix A

Developmental Sequence of the Problem

The initial thesis problem was to determine the reason(s) for the current backlog of 485 outstanding requisitions for MWDs. Attempts to locate information about the MWD Program led mostly to military regulations, with very little information about training, management, procurement, or use by the Using Agencies. As a result, the author developed a questionnaire and sent it out to 12 subject matter experts in an attempt to gain a perspective of the current status of the MWD Program and to invite evaluation of said program.

The responses to the questionnaire appeared to cover the complete spectrum of what was wrong with the MWD Program, to include the causes for the backlog of requisitions. It became apparent to the author that the degree of disparity among the responses and the absence of descriptive documentation of the overall MWD Program were both due to the lack of a comprehensive source of readily obtainable information about the MWD Program.

The questionnaire responses were then tabulated and examined for commonality of response. From this exercise it became apparent that there were 3 main causes of the backlog problem, namely command and control, procurement, and the rejection rates of dogs undergoing training at the DODDC.

After discussing these findings with numerous respondents, personnel at the DODDC, and the Thesis Committee, the author concluded that was impossible to establish a consensus of opinion. The Training Section blamed the procurement and management sections for the shortfall of trained dogs,

or vice versa, depending on which group was queried. The author thus concluded that the answer could not be found within the DODDC for the many reasons mentioned and described within this text.

The decision was then made to begin with the 12 original Subject Matter Experts and DODDC personnel, and to search trade magazines and refereed journals to identify additional contacts and sources of information. The intent was to collect as much information, in variety and source, as would be possible during the time allotted to write the thesis. The end goal was to find common denominators that could be reliable indicators of a successful working dog operation. This search ended with more than 187 personal contacts (subject matter experts), both domestic and international, and over 348 written pieces of information from journals, magazines, newspaper articles, memoranda, white papers, letters, telephone and oral interviews, cassette tape recordings, and video tapes. This information covers a wide range of topics, including genetics, reproduction, procurement, training, behavior modification, olfactory research, and the development of microsensors.

The goal then became to obtain as much information as possible and to compile a list of contacts who would be willing to assist in establishing a central source of information. This information, when presented in an organized manner, could then be used to keep abreast of current developments and to identify those common denominators that ensure the production of consistent high quality working dogs.

Appendix B

**MASTER OF MILITARY ART AND SCIENCE (MMAS) RESEARCH
AND THESIS QUESTIONNAIRE**

**Command and General Staff College
ATTN: ATZL-SWO-E
Fort Leavenworth, Kansas 66027-6900**

**Telephone: AV 552-3320/2635
Commercial (913) 684-3320/2635**

**POC: CPT Denzil F. Frost
Ernest G. Lowden, Ed.D.
MAJ Thomas G. Tecec**

September 1989

QUESTIONNAIRE

NAME: _____

DO YOU WISH TO REMAIN ANONYMOUS? YES____, NO____

CURRENT POSITION: _____

MILITARY WORKING DOG EXPERTISE: _____

PLEASE WRITE YOUR ANSWERS IN THE SPACES PROVIDED, AS THEY REFLECT
YOUR EXPERTISE. DO NOT FEEL LIMITED BY THE SPACE PROVIDED. YOU MAY
USE THE BACK OF EACH SHEET OR INSERT ADDITIONAL PAGES, IDENTIFIED BY
QUESTION NUMBER.

1. CURRENTLY, THE MAJORITY (98 PER CENT) OF THE DOGS SELECTED FOR TRAINING COME FROM NORTHERN EUROPE, AT AN AVERAGE COST OF \$1,442.00 PER DOG. UNDER THE CURRENT SYSTEM THERE ARE APPROXIMATELY 485 OUTSTANDING REQUISITIONS THAT CAN'T BE FILLED. CONSIDERING THE HEAVY DEPENDENCE ON A FOREIGN MARKET AND THE SHORTAGE OF DOGS TO MEET MISSION DEMANDS,
 - (A) SHOULD THE CURRENT PROGRAM BE CHANGED?
 - (B) WHAT WOULD BE SOME POSSIBLE ALTERNATIVES TO THE EXISTING PROGRAM?
2. COULD KENNEL-RAISED DOGS ALLEVIATE THE PROCUREMENT BOTTLENECK, AND PROVIDE A BETTER QUALITY, TRAINED DOG TO THE USING AGENCIES?
3. THE MAJORITY OF THE USING AGENCIES REQUEST DUAL-PURPOSE DOGS.
 - (A) COULD GENETICALLY SELECTED AND KENNEL-RAISED DOGS MORE ADEQUATELY MEET THESE REQUESTS?
 - (B) WOULD IT BE BETTER, EVEN WITH AN ABSOLUTE IDEAL DOG, TO TRAIN A DOG FOR ONLY ONE MISSION SPECIALTY?
4. WHAT WOULD BE SOME OF THE DRAWBACKS OF ESTABLISHING AND USING KENNEL-RAISED DOGS?
5. FROM YOUR LIST OF DRAWBACKS, WHICH COULD BE SOLVED, AND WOULD THE EFFORT BE WORTH IT?
6. FROM SEPTEMBER 1968 TO APRIL 1976 THE GOVERNMENT CONDUCTED RESEARCH CONCERNING THE FEASIBILITY OF RAISING DOGS FOR THE AND TO GENETICALLY SELECT FOR THE DESIRED TRAITS. THIS RESEARCH PROJECT BECAME KNOWN AS THE BIOSENSOR PROGRAM.
 - (A) WHAT HAVE YOU LEARNED FROM THIS PROGRAM?
 - (B) WHY DO YOU THINK THE PROJECT WAS DISCONTINUED?

7. PLEASE CONSIDER IN YOUR RESPONSE THE ADVANTAGES AND DISADVANTAGES OF GENETICALLY SELECTED AND KENNEL-RAISED DOGS TO FULFILL POTENTIAL REQUIREMENTS OF EXPANDED USE.
 - (A) DO YOU FORESEE A VALID NEED TO EXPAND THE MISSIONS OF THE MILITARY WORKING DOG?
 - (B) IF YOUR ANSWER IS YES, WHAT WOULD BE SOME OF THE EXPANDED MISSIONS AND TO WHOM WOULD THESE SPECIALLY TRAINED DOGS APPEAL?
8. IF YOU ANSWERED NO TO QUESTION # 7, WHY DO YOU FEEL THE CURRENT PROGRAM AND QUALITY OF DOG USED CAN MEET THE NEEDS OF THE USING AGENCIES?
9. (A) DO YOU THINK THAT THE CURRENT EMPHASIS ON HIPS AND ELBOWS IS APPROPRIATE FOR EVALUATION OF A DOG'S POTENTIAL TO SERVE AS A MILITARY WORKING DOG?
(B) DO YOU THINK THE CURRENT TRAINING REQUIREMENTS AT THE DEPARTMENT OF DEFENSE DOG CENTER REFLECT REALISTIC CRITERIA FOR EVALUATING THE TRAINING POTENTIAL OF CANDIDATE DOGS?
10. IDEALLY, ONE WOULD PREFER TO HAVE A MINIMAL NUMBER OF CRITERIA WHICH COULD BE USED AS STANDARDS FOR ENSURING OPTIMAL IDENTIFICATION OF CANDIDATES WHO HAD THE MOST TRAINING POTENTIAL. WHAT CANINE CHARACTERISTICS SHOULD BE IDENTIFIED AS OPTIMAL FOR ASSESSING TRAINING CAPABILITY?
11. WHAT VARIABLES SHOULD BE CONSIDERED IN THE COST ANALYSIS COMPARISONS BETWEEN THE CURRENT PROCUREMENT SYSTEM AND THE TWO KENNEL PROPOSALS, GOVERNMENT-OWNED VERSUS PRIVATE CONTRACTOR?
12. ASSUMING THE DECISION WAS MADE TO INITIATE A BREEDING COLONY AND KENNEL FACILITY FROM WHICH TO PROCURE MILITARY WORKING DOGS, HOW WOULD YOU AVOID THE 'UPS AND DOWNS' OF SUPPLY AND DEMAND FOR THE MILITARY WORKING DOG AS EXPERIENCED IN THE PAST?

Appendix C

QUESTIONNAIRE SUMMARY

<u>QUESTION</u>	<u>RESPONSE</u>	<u>* OF SIMILAR RESPONSES</u>
1A	yes	11
	decreased quality	2
	foreign source	3
	logistical problems	2
	training	2
	fragmented management/bickering	2
1B	advertise	3
	multi-source	2
	reevaluate breeds	1
	use genetic pool	1
	breeding program	6
	better training	4
	better selection criteria	3
	start a government kennel	3
	start civilian kennel contract	2
	one directorate	2
	individualize training	1
	discontinue dual-purpose training	1
	buy fully trained dogs	1
2	yes	10
	no	1
	improve quality	2
	control genetic base	2
	be responsive to demand	1
	early training	2
	expensive	5
	feasibility doubtful	3
	proper socialization	4
	long start-up time	5
	labor intensive	2
	disposal of rejects (many)	2
	media sensitive	1
	anything is better than current program	1

<u>QUESTION</u>	<u>RESPONSE</u>	* OF SIMILAR RESPONSES
3A	in favor of dual-purpose	5
	not known	3
	requirements don't match capability	3
	ideal dog - yes, but rare	3
	reason for backlog	1
	must quantify	1
	task dependent	2
	more efficient	1
	more versatile	1
	enhance with early exposure	2
	less kennel space	1
3B	favor single-purpose	4
	abolish backlog	2
	more efficient	2
	more versatile	1
	majority better suited	4
4	expense	9
	labor intensive	4
	socialization	4
	no guarantees/disease outbreak	3
	long time requirement	6
	disposal of rejects	5
	initial bureaucratic inertia	2
	inter-agency rivalry	1
	acceptable site	4
	competition with civilian breeders	1
	animal rights movement	1
5	all	6
	none	1
	requires coordination	1
	one person/agency control	2
	need senior level support	1
	must satisfy demand	1
	side benefits to USDB, and handicapped	2
	no solution to initial time required	1

<u>QUESTION</u>	<u>RESPONSE</u>	<u>* OF SIMILAR RESPONSES</u>
6A	some biosensors were very skilled	2
	keep research & development (R&D) out	1
	place all control with DODDC	1
	proper expertise	1
	short duration (< 10 yrs)	1
	couldn't convert R&D operation	1
	very expensive	1
	hip dysplasia partially controlled	
	genetics and environment	1
	temperament highly heritable	1
	negative correlation between	
	hip dysplasia and temperament	1
	not familiar with project	3
	locate in less temperate climate	1
	develop better criteria	2
	prioritize selection criteria	2
	pressure to fill kennels (< quality)	1
	need to solve socialization problem	1
6B	lack of results	1
	budgetary cuts	6
	lack of commitment/politics	2
	animal rights pressure	1
	decreased demand	3
	lack of support outside AMEDD	1
	not familiar with project	3
	too many people involved	1
	lack of centralized control	1
	over-emphasis on R & D	1
	poor public relations	1
	Director retired	1
	musculoskeletal defects still high	1
	end of Vietnam War	1
	intra-organizational rivalry	1
	own paper published in Vietnam	1

<u>QUESTION</u>	<u>RESPONSE</u>	<u>* OF SIMILAR RESPONSES</u>
7A	yes dogs are excellent sensors can't trust 80-90 per cent efficiency fill existing vacancies first low intensity conflict Drug Enforcement Administration antiterrorist Military Operations in Urban Terrain no available technological substitutes genetically selected and kennel- raised are mutually exclusive	10 1 1 1 2 1 1 1 1 1
7B	tracker scout narcotic explosive patrol search and rescue sentry casualty detector mine/tunnel illegal food inspection pack animals good-will ambassadors	5 3 5 3 1 2 1 3 3 1 2 1
8	no yes no response	7 1 1
9A	yes no not qualified to answer early removal locomotion problems emphasize life-extension factors hips/elbows problems are primary causes for euthanasia Malinois - possibly different criteria required	7 1 3 1 1 2 2 1

<u>QUESTION</u>	<u>RESPONSE</u>	<u>* OF SIMILAR RESPONSES</u>
9B	no	3
	yes	2
	not qualified to answer	1
	needs reevaluation	3
	Degenerative Joint Disease - related to training	1
	do not know	2
	not consistent with procurement criteria	1
	dogs seem to be performing well	1
10	not fearful/biter	2
	not disturbed by noise	1
	good nose	4
	attentive	5
	sound health	4
	dominant behavior	3
	curious	1
	aggressive	3
	no excessive submission	1
	no phobias	2
	obedient	2
	good hearing	2
	loyalty	1
	self confident	2
	behaviorist's responsibility	2
	intense play drive	1
11	government control	1
	costs of tapping world-wide genetic base	2
	not qualified to answer	1
	certification rates	2
	elimination rates	4
	side benefits	1
	goal - provide the best candidate-trained dog	1
	OCONUS vs CONUS	1
	quality comparisons	2

<u>QUESTION</u>	<u>RESPONSE</u>	<u># OF SIMILAR RESPONSES</u>
11 con't	availability	1
	capability	1
	adequate training	2
	womb -> tomb	1
	transportation	1
	procurement team	1
	personnel	2
	maintenance	1
	public relations	1
	colony stock	2
	overhead expenses	1
	animal rights activists	1
	start up costs	1
	current vs change	1
12	central management-single agency	3
	account for female cycling	1
	demand driven by world situations	1
	forecast projections (> 18 months)	4
	alternate procurement sources	1
	expand source of demand	2
	do not see as a problem	1
	educate users	1
	decrease kennel costs	1
	expand use of MWDs	1
	periodic surveys of user's needs	1
	excess sales/give always	1
	identify past causes	1

Appendix D

Contact Roster

<u>NAME</u>	<u>ADDRESS</u>	<u>TELEPHONE</u>
Amm, Brian	Canadian Police Canine Association 8004-4A Street, NE Calgary, Alberta Canada T2K5W8	
Andersen, Gary, LTC D.V.M., M.S.	DODDC, HSHM-VET-DC Building 7595 Lackland AFB, TX 78236-5000	AV 473-3991 512-671-3991
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Arson Dog (Mattie)	Connecticut State Police Emergency Services Division Box 129 Colchester, CT 06415	203-566-4025
Bailey, Cheryl	American Kennel Club Librarian 51 Madison Avenue New York, NY 10010	212-696-8245
Ball, Jim	Marshall Farms Road #1, Box 91 North Rose, NY 14516	315-587-2295
Berger, David	State of Connecticut Department of Public Safety Division of State Police 294 Colony Street Meriden, CT 06450	203-238-6026

Beaver, Bonnie D.V.M., M.S.	Department of Small Animal Medicine and Surgery College of Veterinary Medicine Texas A & M University College Station, TX 77843-4474	409-845-2351
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Bickel, Carl	National Criminal Justice Reference Service National Institute of Justice Box 6000 Rockville, MD 20850	800-651-3420 301-251-5500
Bielfelt, Sherman M.S.	1080 Verano Avenue Sonoma, CA 95476	707-996-4701
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Boyce, Richard R. D.V.M.	American Veterinary Medical Association 930 N. Meacham Road Schaumburg, IL 60196	800-248-2862
Brackman, Jane L.	International Guiding Eyes 13445 Glen Oaks Blvd Sylmar, CA 91342	818-362-5834-Adm 818-362-6877-Tng
Bradley, J. R., MAJ	Commandant U.S. Disciplinary Barracks ATTN: MAJ Bradley, XO Fort Leavenworth, KS 66027	AV 552-3871 913-684-3871

Brannaka, D.C.	USDA-APHIS, PPQ 13601 Old Cutler Road Miami, FL 33158	305-232-8827
Brayton, Ginger	111 Creek Circle Seaford, VA 23696	804-898-7118
Brown, Hildegarde	PAO - DCOS Lackland AFB, TX 78236-5000	AV 473-4292 512-671-4292
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Burke, Dennis	K-9 Enforcement Program U.S. Customs Service HCR Box F Front Royal, VA 22630	202-566-8188
Burns, James D.V.M.	Ridgian Farms, Inc. 301 W. Main Street Mt. Horeb, WI 53572	608-437-8670
Burr, John, R. D.V.M.	Iams Animal Care Center P.O. Box 189 Lewisburg, OH 45338	800-525-4267 513-962-2624
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Carrol, Tom, D.V.M.	Hazelton Research Products Route 2 Box 113 Cumberland, VA 23040	804-492-4181
Castle, William, III	1291 Leidigh Drive Mechanicsburg, PA 17055	717-258-3981
Christopher, Brother	The Monks of the Brotherhood of Saint Francis New Skete Monastery Cambridge, NY 12816	518-677-3928
Clark, Terry	9703 Five Forks San Antonio, TX 78245	AV-945-3536 512-674-4021
Clark, William, COL (Ret), D.V.M., M.S.	HQDA (DASG-VC) 5109 Leesburg Pike Falls Church, VA 22041-3258	AV 289-0450 202-756-0058
Commandant	Military Working Dog Center Amphoe Packchong Nakhon Ralchasima Thailand	202-333-9381 (Thai Embassy)
Commandant (Jungle Warfare Center)	Pusat Latihan Darat Ulu Tiram 81800 Johor Baru Malaysia	202-328-2700 (Malaysian Embassy)
Cooper, James, COL D.V.M., M.P.H.	Academy of Health Sciences Veterinary Science Division ATTN: HSHA-IVS Fort Sam Houston, TX 78234-6000	AV 471-2822 512-221-4189
Coppinger, Raymond Ph.D	Livestock Dog Project Farm Center Hampshire College West Street Amherst, MA 01002	413-253-7065

Craig, Dan, J. D.V.M., M.S.	3280th TCHTG/TTMD B Lackland AFB, TX 78236	AV 473-4579 512-671-4579
Doiley, Robert	Capitol Recovery Services 10474 Armstrong Street Fairfax, VA 22030	703-934-9050
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Davola, Peter	The U.S. Police Canine Association, Inc. Region 11 420 N.W. 56th Street Lawton, OK 73505	AV 639-4713 405-351-4713
	Defense Technical Information Center Building 5 Cameron Station Alexandria, VA 22304-6145	AV 284-6434 202-274-6434 202-274-6867
Dennis, S.J., Captain	Commandant (G-OLE-3) U.S. Coast Guard HQ 2100 2nd Street S.W. Washington, D.C. 20593	202-267-1890 202-267-1776
Devaney, Matthew	Deputy Director Alabama K-9 Law Enforcement Training Center 202 Skyland Blvd. Tuscaloosa, AL 35405	205-759-4619
Dorly, Jeffrey	American Kennel Club AKC Gazette 51 Madison Avenue New York, N.Y. 10010	212-696-8332

Drexler, Rudy	Rudy Drexler's School for Dogs 50947 County Rd. 7 North Elkhart, IN 46514	219-264-7518
Dunlap, Harris L.	Zero Kennel Box 11 Baker's Mills, NY 12811	518-251-2860
Durrant, Brig. G. R.	MOD(AVRS) GALLWEY Rd., ALDERSHOT, HANTS (Liasion Office - GU11 2DQ	202-756-8177 LTC Lyon)
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	FEDLINK Technical Notes Federal Library and Information Center Committee FEDLINK Network Office Adams Building, RM 1026 C Washington, D.C. 20540	202-707-6454
Fenton, Jeff	5215 West Brown Street Glendale, AZ 85302	602-937-3682
Fox, Frank , Jr.	ALPO Center for Advanced Pet Study P.O. Box 2187 Allentown, PA 18001	215-395-3301
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Frost, David C.	Tennessee Valley Authority Section Supervisor K-9 Program Watts Nuclear Plant P.O. Box 800 Spring City, TN 37381	615-751-6783 615-365-3726
Frost, Denzil F., MAJ M.S., D.V.M.	Armed Forces Institute of Pathology Department of Veterinary Pathology Washington, D.C. 20306-6000	AV 291-2454 202-576-2453
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Fuller, William J. D.V.M.	The Kynological Society 4880 Stoney Creek Rd. Avoca, MI 48006	313-861-7606

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Hancock, Daniel, LtCol	HQ, ATC/XPCO Command Analysis Division Randolph AFB, TX 78150-5001	AV 487-2640 512-652-2640
Holliman, Joe	White Eagle Laboratories 2003 Lower State Road Doylestown, PA 18901	215-348-3868

Hammond, Shirley	1062 Metro Circle Palo Alto, CA 94303	415-856-9669
Hayter, Dan	Global Training Academy Somerset, TX 78227	512-429-3122
Helm, Frederick, COL D.V.M., M.S.	Deputy Commander for Veterinary Services WRAMC Washington, D.C. 20307	AV 291-5021 301-427-5022
Hess, Russell	National President - U.S. Police Canine Association 325 East Street Springboro, OH 45066	513-748-9646
Hoodman, Liz	Canine Chronicle 2204 Justice Street Monroe, LA 71201	318-361-0643
Houpt, Katherine V.M.D., Ph.D	American Veterinary Society for Animal Behavior NY State College of Veterinary Medicine Cornell University Ithaca, NY 14853-6401	607-253-3450
Hughes, Nylo	Purina Kennel News® Ralston Purina Company Checkerboard Square St. Louis, MO 63164	314-982-5960
Ibrahim, Connie, Sgt.	Supervisor, K-9 Detail City of Miami Police Department Miami, FL 33125	305-579-6111

Irving, Betsy (Administration)	Guide Dogs for the Blind, Inc. 350 Los Ranchitos Road P. O. Box 1200 San Rafael, CA 94915	415-499-4000
Jarvis, Lynn, Ph.D	Microsensors Systems 6800 Versar Center Springfield, VA 22151	703-642-6919
Jepson, Paul, LTC	MOD(AVRS) GALLWEY Road, ALDERSHOT, HANTS GU11 2DQ	
Jerszyk, Marion Ph.D	The Seeing Eye, Inc. P.O. Box 375 Morristown, NJ 07963-0375	201-543-4262
Johnson, Carl D.V.M.	International Embryo Transfer Society 309 W. Clark St. Champaign, IL 61820	217-356-3182
Johnson, Glen R.	Guardian Training Academy, Inc. RR 1 Highway #? Old Castle, Ontario Canada NOR 1L0	519-737-6372
Johnston, Shirley D.V.M., M.S., Ph.D	University Veterinary Teaching Hospital 1365 Gortner Avenue St. Paul, MN 55108	612-625-1960
Jolivette, Gerard Capt	HQ, AFOSP/SPO Kirtland AFB, NM 87117	AV 244-6627 505-844-6627
Kay, Debbie	International Dogs Detector, Ltd. P.O. Box 308 Miller's Tavern, VA 23115	804-443-6998 804-443-1124

Kilby, Edward	The American Bloodhound Club 1914 Berry Lane Daytona Beach, FL 32124	904-788-0137
Kraemer, Duane D.V.M., M.S., Ph.D	Department of Physiology and Pharmacology College of Veterinary Medicine Texas A & M University College Station, TX 77843-4474	409-845-7261
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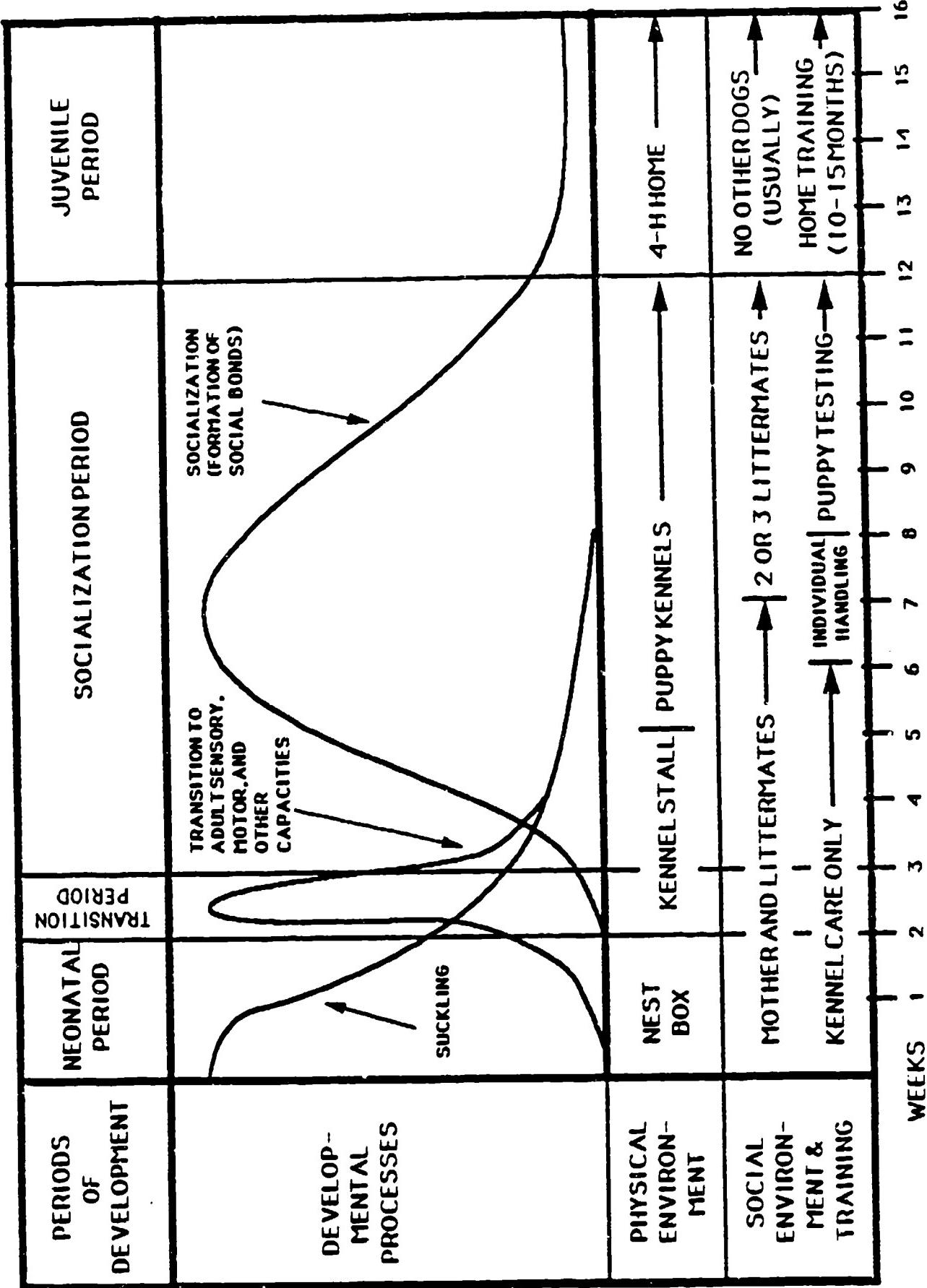
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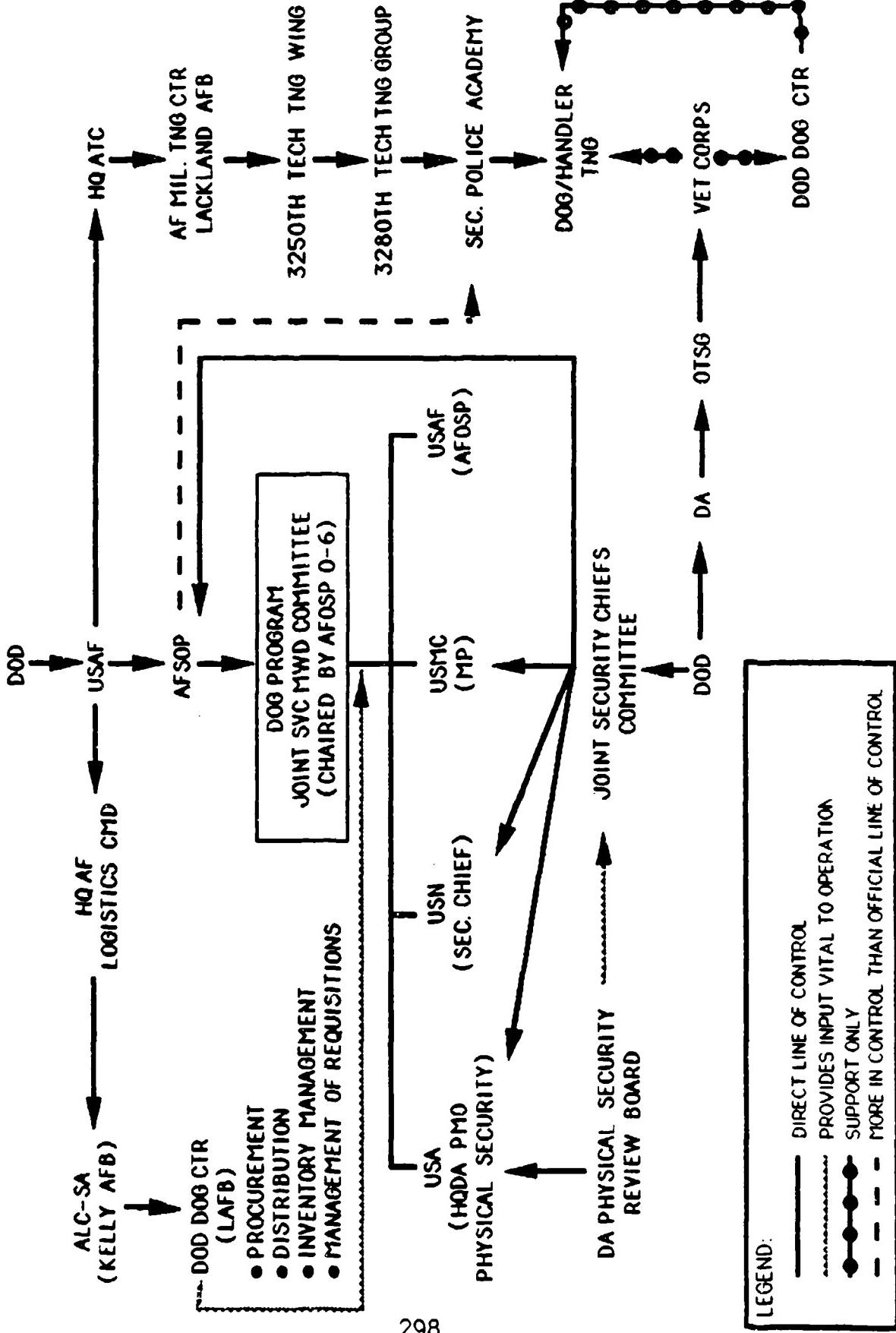
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Appendix E



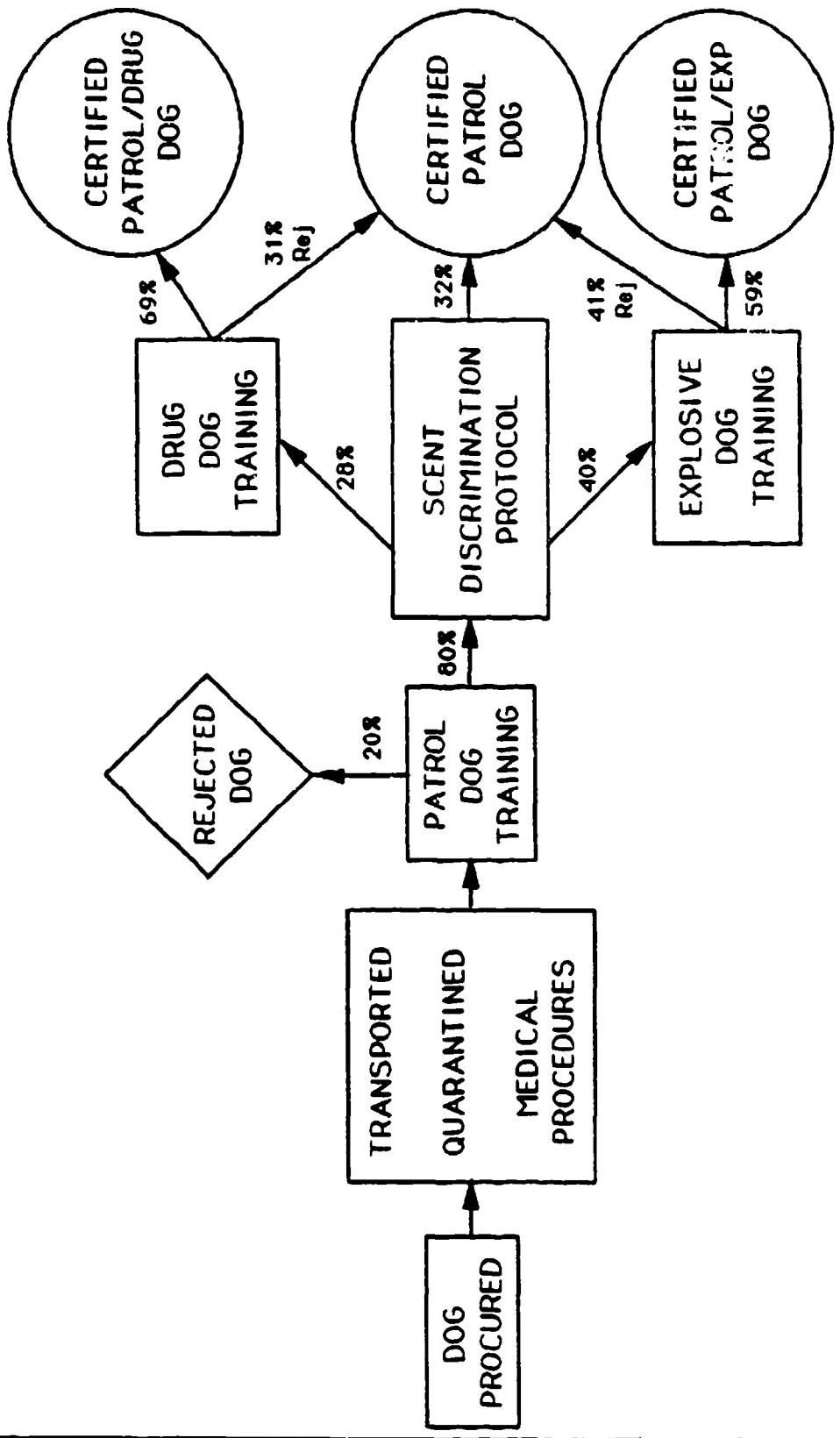
Appendix F

COMMAND AND CONTROL MWD PROGRAM



Appendix G

FLOW OF DOGS THROUGH THE MWD TRAINING PROGRAM



Appendix H

Official Military Literature

Army Regulations (ARs):

- 40-3, Medical, Dental and Veterinary Care
- 40-905, Veterinary Health Service
- 190-2, Guidance on Dissent
- 190-11, Physical Security of Arms, Ammunition and Explosives
- 190-12, Military Police Working Dogs
- 190-13, The Army Physical Security Program
- 190-14, Carrying of Firearms and Use of Force for Law Enforcement and Security Duties
- 190-22, Search, Seizure and Disposition of Property
- 310-25, Dictionary of United States Army Terms (Short Title: AD)
- 310-50, Authorized Abbreviations and Brevity Codes
- 351-7, Individual Training Requirement Solicitation for Army Service Schools
- 385-30, Safety Color Code Markings and signs
- 385-64, Ammunition and Explosives Safety Standards
- 700-81, DOD Dog Program

Field Manuals:

- 7-40, Scout Dog Training and Employment
- 7-41, Mine and Tunnel Dog Training and Employment
- 7-42, Combat Tracker and Tracker Dog Training and Employment
- 19-5, The Military Policeman
- 19-10, Military Police Administration and Operations

19-20, Military Police Investigations
19-30, Physical Security
19-35, Military Police Working Dogs
20-20, Basic Training and Care of Military Working Dogs
22-6, Guard Duty

TM19-5, Bomb Threat Planning

Department of Defense Directives (DOD Directives):

4270.1M, Kennel Construction Criteria
5200.1, Single Manager for DOD

Department of the Army Pamphlets (DA Pams):

108-1, Index of Army Motion Pictures and Related Visual Aids
310-series, Military Publication Index Series

Training Films (TFs):

19-3880, Guard Duty (Interior and Exterior)
19-3993, Physical Security at NIKE Hercules Sites

FORSCOM/TRADOC LETTER, Military Working Dog Certification

Air Force Regulations:

125-5, USAF -Training

Air Force Fact Sheets:

87-10, Military Working Dogs

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